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# AVIATION WEEK

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## Editorial Office

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## REFERENCES

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**COVER:** Douglas C-124 Globemaster, one of eight from Tactical Air Command's 15th Air Force at Donalson AFB, S. C., unloading supplies at Antarctica, ties on the Newy ice ship at McMurdo Sound. Three C-124s have made daily 1980 australis day missions to a base at the South Pole prohibited to take observations for the International Geophysical Year.

### Future Considerations

307 106 109—Harvard Levy

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## EDITORIAL

### What the Budget Means to Airpower

President Eisenhower's Fiscal 1958 federal budget request to Congress contains good and bad news for airpower.

Brighter spots are the substantial increases asked for the National Advisory Committee for Aeronautics larger some research program and the Civil Aeronautics Administration's modern airway airports and traffic control system.

Glooming outlook is for the Air Force, where the Fiscal 1958 budget as it now stands will set in motion a gradual, but significant, decline in USAF combat capability.

The National Advisory Committee for Aeronautics is perhaps the most difficult agency, budgeted in the Independent Offices Appropriation Bill, for both the executive and legislative branches of the government to understand. This is because of the advanced technical frontier on which NACA battles the unknown, and, in so small measure, because decisions on its priorities are not made by the more astronomically knowledgeable committees of Congress such as the Armed Services Committee or the armed services subcommittees of the Appropriations Committees. Yet, there are few people working in aviation technology who are not indebted to NACA in some measure or another for more than 40 years of steady and often spectacular additions to the basic knowledge of the field. Whether classic American airplanes—both military and commercial—can be said to international in periods, runs freely on a knowledge of basic research data contributed by the NACA laboratories.

#### NACA: Sound Investment

With the background, it is gratifying to see the vital role of NACA in the technical advances into the larger some areas recognized with a budget score in keeping with its responsibilities. The \$41 million requested for new NACA hypersonic research facilities is a relatively small item in federal budgets go. But it represents a sound investment in the aeronautical future that will eventually yield a high return in the quality of billions of dollars of aeronautical equipment produced during the next decade.

We would be very much surprised if the new NACA Chairman Dr. James Harold Doolittle, wartime commander in chief and close personal friend of President Eisenhower, did not have something to do with the above intelligent consideration of the NACA research problems in the federal budgetary context.

In the vastly supported Civil Aeronautics Administration airway budget, it again would be difficult to escape the influence of another of President Eisenhower's war-time advisors and post-war friends—Edward F. Carr, who is now serving as a special assistant adviser to the President. The vital necessity for a modern, safe, automatic airway airports and traffic control system is so new to the readers of *Airman's* War. But it has been a long, better little to impress that fact on both the executive and legislative branches of the government. With its knowledgeable advice as Mr. Carr at the

President's side and in vigorous and forward-looking leadership as that provided by the new Civil Aeronautics Administrator James T. Pyle, the case for the new airway system has never been more favorably presented.

It is heartening to think that a reasonable case on vital aviation problems properly presented can stir adequate action at the top level of the government. The significantly increased federal airway budget requested by the President for Fiscal 1958 should be much to get this program out of the doldrums in which it has languished for the past three years and off to a reasonable start to eventual solution.

#### President's Endorsement

Also, accompanying is the President's strong endorsement of the B-52, airport to provide the nation's capital with a terminal suitable for jet transport operations. There has been enough political log rolling and bureaucratic inertia on this problem. Unless firm action is taken on a new Washington airport this year, the jet transport era will dawn in 1960 and pass the capital by.

In the Defense Department budget, naval aviation is contained at its current levels with strong emphasis upon modernization of its first line fighting aircraft and their floating bases. Perhaps more critics will note the lack of an increase in anti-submarine warfare capabilities in the naval air program that is commensurate with the growth of the Russian submarine threat.

Army aviation will continue to prosper within the modest limits set for it by the Defense Department.

But the USAF budget presents a picture that is certain to stir the most bitter debate on airpower in Congress of the postwar era. The congressional leaders of the fight for a quantitative and qualitative boost in USAF combat strength should take heart from their victory on the Fiscal 1957 budget. For the level and tone of the Fiscal 1958 budget clearly shows that they, and not the President, were correct in the appraisal of the airpower problem last year.

#### Additional Funds Used

Despite constant statements by administration spokesmen that USAF could not use more funds than the President's original budget request in Fiscal 1957, the record now shows that the more than \$1 billion added by the congressional debate and pressure was in fact not only made but used to speed the B-52 and long-range ballistic missile programs.

It is significant that USAF Secretary Donald Quarles, by so much of the imagination on airpower itself, is visibly unhappy over USAF's slice of the Fiscal 1958 budget. Even Defense Secretary Charles E. Wilson made a strong push to the White House for substantially more USAF funds than now appear in the budget. This is too complex a subject to consider further in this space but we will have more to say about it next week.

—Robert Hottel

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At the bottom left is a turbine disc forging made from high density heat treating alloy, and next to it is a titanium compressor wheel forging for two of the most powerful jet engines yet produced.



## WHO'S WHERE

### In the Front Office

**Norman Chandler**, president of the Los Angeles Times, and **Roger Lewis**, FAA executive vice president development and defense research director, *Plan. Aerospace World America, Inc.* Also **Robert E. Mares**, Jr., executive vice president Pacific Alaska Dr. Co.

**Lawrence Oppenheim, Jr.**, industrial management national relations consultant in Dallas, *Care Hydrostatics, Inc.* James N. V.

**Harry Harris**, board chairman, *Colonial Corp. White Plains N. Y.* Joseph Friedman, executive vice president.

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**Harold Ames, Jr.**, president, *Electro-Scrap Inc.* and *Manufacturing Co., Chicago, Ill.*

**Wig. Gen. Francis B. Lindner** (USA, ret.), president, *Pratt Electric Corp., Los Angeles, Calif.*

**Dick J. Kaufman**, vice president-general manager U.S. division, *KLM Royal Dutch Airlines*. Also **David A. Chabrowski**, vice president sales, and **Robert E. de Vries**, vice president finance.

**John Minton**, executive vice president, *Cropper Steel Co., Reading, Pa.*

**Joseph Ottavio**, general manager newly established *Nuclear Products Division*, *Mobil Oil & Control Corp.* **Attilio Alessandro**, *Albany Supply Engineering Company*.

**Thomas Swisher**, production manager, *Dr. A. E. Mahoney*, manager control systems division.

### Honors and Elections

**Charles J. McGuffee**, chairman of the board of *Clairmont Aircraft Service, Inc.*, has been named a trustee of the National Airworthiness Committee for Airlines for a full year. Mr. McGuffee succeeds **Arthur E. Rosenwald**, vice president and director engineering for *Douglas Aircraft Co., Inc.*, whose term has expired.

**Carl G. Gault** has received the A. H. Hays Award for outstanding achievement in achievement and demonstrated ability in test aircraft of USAF Experimental Flight Test School, Edwards AFB, Calif. The award was presented to Brig. Gen. J. S. Hefner for the last time in the honor it will be moved only as suitable to suit standing members of the flight test club.

**Miss J. H. Dunbar**, the wife of Gen. James H. Dunbar, was presented the William J. McGuffee Memorial Award by Air Service Test School. She is the oldest air service pilot in the American Legion. "For her contributions to aviation through the years." Mrs. Dunbar was the initial winner to win the McGuffee Trophy, the first being Mrs. Josephine Galt.

**Capt. John E. Bower**, USN, manager of television technical operations at the National Broadcasting Co., Hollywood, has received the Navy's Bronze Star Medal and an accompanying citation for his part in developing the first medium altitude jet launched in wartime against Germany.

## INDUSTRY OBSERVER

► **Republic R105** program now calls for production of 16 F-105A and F-105B supersonic fighter-bombers for a strategic mission and test program. USAF will have letters of the program upon the results of the extensive test program it has planned.

► **USAF WS-475A** nuclear powered bomber program has been definitely stretched out due to technical problems in powerplant development. Four planned contractors for the program—Lockheed, General Electric, Pratt & Whitney—were officially notified of the stretchout by Air Research and Development Command early this month.

► **General Aircraft Engineering Corp.** is working on a new early warning radar plane design for the Navy.

► **Douglas** has announced that its missile prototype failed to get off the launching pad at USAF Missile Test Center, Patrick AFB, Fla., test work is scheduled. Problems with launching equipment delayed the first firing of USAF's intermediate-range ballistic missile.

► **X-15** taking VTOL research plane (AW April 8, 1956, p. 37) will be back to Hiller for USAF. Air Force will launch two Fitch G-125 transport for the experimental work, one to be modified to the new configuration, the other to be used for space. Navy will launch X-15B by Atlas TF-45A-14 transport against the project. Design gross weight will be 37,000 lb.

► **Fiscal 1956 Defense Department budget** contains funds to adequately finance production of either the *Avon's* Nike B or the *Avon's* Titan aircraft, missile or jet defense. Decision will have to be made soon as to which missile will get their production funds.

► **USAF** will have to make a decision soon on how much of its missile money it will allocate to IRBM work on the *Avon's* Jupiter project at the Redstone Arsenal. But Pentagon gives at the moment—no such work.

► **General Aircraft Engineering Corp.** is making a strong bid to enter into the missile field which it left several years ago. General Aircraft is now considering two proposals—a long-range cruise type missile and a short-range, low speed missile, both for the Navy. In addition, General Aircraft is making a number of its industry from an aerial other proposals, including an anti-air missile.

► **Avon** now give Bell Helicopter Corp. a contract to three triple-engine powered tandem helicopters. Company designation for the helicopter is the M-21.

► **Four KC-135** jet tanker transporters have been ordered out of Boeing Airplane Co.'s Renton, Wash., plant. A fifth plane is due out by the end of the month. A total of approximately 100 light bombers have been accumulated by the first two planes to come off the line. The first is scheduled to fly before the end of the month.

► **Lockheed Aircraft Division** is conducting extensive research on broad-area control and expects to move up with an application for a modified G-125 transport sometime next year. The system will incorporate use of more powerful compressors than ever and below sea order to force extra air over left surface and several bell control surfaces.

► **Kollsman** plans a test program for its 11,000 lb thrust RA-29 Avon turbojet to log 10,000 engine flight hours in Coast Airlines by the end of 1956. Program calls for two Coast II airplanes to each use a pair of RA-29 engines in the island nacelles on a B-54C cargo service between Los Angeles and Reno and a 500 hour test program for each of the four RA-29s loaded in the Coast IV prototype. Cargo operations are scheduled to produce 8,000 hours of RA-29 time and the Coast IV prototype testing 2,000 hours.



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Philadelphia, Pa., this hose outlasts Urethane Silicone Rubber in resist temperatures from +150 to -50 deg. F. Troughing less than one pound per foot, it offers great flexibility for use at handoffs, and is highly resistant to abrasion.

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## Washington Roundup

### Hidden Budget Fuzes

Capital Hill fireworks over the Defense Department budget are muted, but the military services will light fires only from behind the scenes. All personnel statements for the House and Senate committees, and be submitted to Defense Secretary Clark M. Wilson by tomorrow for his approval and "coordination."

Congressional budget proposals will be started by Democratic critics of the administration. In addition to the Senate's subcommittee report on its panel, critics will have gathered from the recent hearings on the proposed Eisenhower Directive for the Middle East and elsewhere, respectively, provided by military spokesmen. As Army colonel already under investigation has more of a "hot" line, in Congress from the Republic's Armed Forces last year's experience. Wilson is taking a cautious and friendly approach to Capital Hill. He already has cautioned senior Congressional leaders at a Pentagon breakfast.

### Disarmament Reaction

Former USAF Secretary Thomas K. Doolittle takes issue with the administration's new disarmament proposal, recently announced by President Eisenhower and upheld as it is in the U. S. Ambassador to the United Nations, Herbert Gold, says. Doolittle makes a number of challenges. "The proposal sets upon 'partial' disarmament, a gradual weakening of military power and other defense strengths."

The President's proposal made "no reliable statement which would remove the threat level out of our own degrading nuclear weapons, especially provide against the possibility of surprise attack, entirely control the outer space missile and satellite development, and make feasible" studies aimed toward and military budgets.

Doolittle told the Senate Government Subcommittee that an effective program must be to "complete" disarmament in steps—with no reduction in the air atomic capabilities, means for the full stage. He said that, under a "partial" disarmament program, neither the U. S. nor Russia would agree to an agreement that would place it at a relative disadvantage—meaning there would be no real disarmament at all.

Both Doolittle and Sen. Stuart Symington (D-Mo.), also a former Secretary of the Air Force, dispute Secretary of State John Foster Dulles' statement that the U. S. military position vis-a-vis Russia has not deteriorated over the past few years. Symington contends that Dulles' statement is at odds with the testimony by his brother Allen Dulles, head of Central Intelligence Agency, made during a committee hearing of the Senate Government Subcommittee last year.

### Ross Unsusited?

Portuguese observers do not expect Robert Tripp Ross to return to his job as Assistant Secretary of Defense in the Legislative and Public Affairs. He took a leave of absence following publication of reports that clinging knees in need in his wife and brother-in-law held more than \$7 million in military contracts.

Staff of two congressional committees are making preliminary investigations of a possible conflict of interest, since Ross held executive positions with two of the companies, Wren Enterprises, Inc. and Southern Airline Co. before he took his present \$70,000 a year post.

Ross, a former congressman himself, denies any conflict and insists that one document which will list him as an officer of one of the firms is in error. Investigators are checking reports that Ross has arranged for Portuguese military to buy Wren Enterprises' study of aircraft out. Ross' handling of the company in the country of his job has brought frequent criticism from military and industry leaders and the press.

### Bilateral Negotiations

The pace of negotiations on bilateral air transport agreements between the U. S. and other nations is increasing, and some significant conferences are scheduled for the next few months. A U. S. team will in Havana last week discuss the Cuban bilateral, and U. S. and British delegations will work on an agreement of the U. S. United Kingdom bilateral in Bermuda in February.

The Dutch will meet to discuss the rights of Houston and Los Angeles when negotiations for establishment of a U. S.-Netherlands bilateral are resumed in March. Discussions also are scheduled with Belgium.

Key to the program will be the U. S.-U. K. talks in Bermuda since most U. S. interests are based upon principles established in the British pact of 1946.

### New Hurdle for OSI

Continuing its battle against unnecessary secrecy in government, the House Information Subcommittee will in one again to abolish the Office of Strategic Information. This time it will set a familiar route of attack—OSI's budget.

OSI has been under attack for attempting to restrict publication of such matters as unclassified aerial photographs, necessary contact records and information on other installations. After hearings, the subcommittee will in January recommend action on OSI.

Chairman John E. Moss (D-Calif.) now charges that the Government Department let about OSI's past has failed to cooperate with his group by continuously raising questions of OSI's future and by asking for more funds for OSI in the fiscal 1955 budget.

Moss has asked the House subcommittee which must approve OSI's budget to give "serious consideration" to Congress's lack of cooperation.

### 'For Official Use Only'

State tried to Defense Department in its position authority for searching information by using the "For Official Use Only" label will be attached to Congress.

President's Executive Order 10501 permits only three security classifications—"Confidential," "Secret," and "Top Secret." But laws of Portugal papers have the "Official Use Only" stamp—including Portugal's power book.

Rep. John F. Moss (D-Calif.), chairman of the House Information Subcommittee, and Sen. Thomas C. Hennings Jr. (D-Mo.), chairman of the Senate Subcommittee on Governmental Rights, will introduce legislation in the 105th Congress to "authorize" the "Official Use Only" label will make it clear that the law is not authority for withholding information. Rep. Clarence Brown (R-Ohio), a member of Moss' subcommittee will introduce another amendment which would so that the proposed change in the law would not require the government to release security information at information if has received in confidence.

—Washington staff

# \$8.6 Billion Asked for Planes, Missiles

3,200 planes and \$2,640 million for missiles planned for Fiscal 1958 procurement program.

By Claude White

Washington—President Eisenhower's proposed budget for Fiscal 1958 calls for outlays in excess of \$6,112 million in aircraft and \$2,640 million in guided missiles. The estimated figures for Fiscal 1957, which close on June 30, are \$6,259 million for aircraft and \$2,300 million for missiles.

Actual expenditures in Fiscal 1958 are estimated in the White House draft sent to Congress last week at \$6,737 million for aircraft and \$2,659 million for missiles. Congressional spending in Fiscal 1957 was estimated at \$6,786 million for aircraft and \$1,506 for guided missiles.

For the aircraft industry, the budget means that production of jet-and-rocket aircraft will continue at a decline of a fewer rate than at last year since it began going down in 1955. New contracts will be signed in Fiscal 1958 for about 1,200 aircraft. Of these the Navy will get 1,228, almost as many as the Air Force, which is scheduled to sign contracts for 1,317. For Fiscal 1957, USAF was given authorization to buy 1,300 jet-and-rocket planes. In Fiscal 1958 it will contract for about 878 aircraft.

## Wing Goal Chopped

The Defense Department announced today that USAF's 137 wing goal for 1958 is being slashed to 128 wings—then being dropped to 125 wings. Air Force sources indicated after a study of the budget that 128 wings would be a

wise stable estimate of the new goal. The 137 wings had been presented by the end of Fiscal 1957.

According to Defense Department figures, USAF in the end of Fiscal 1958 will have 45 wings in the Strategic Air Command, 32 in the Air Defense Command and 51 in the Tactical Air Command. The TAC strength will include 35 heavy, medium and assault wing aircraft wings.

The actual figure of 128 wings includes four wings never needed in the 137 wing goal set for this year. They are one Mustang wing, retired last year; one Mustang wing, retired last year; one Mustang wing, retired last year; and three C-124 assault transport wings, formerly included among the support aircraft and not counted in USAF's wing program.

## Meyer Loss for TAC

On top of that, it now appears that, even the next few years, SAC will eliminate its fighter wings and Air Defense Command two-day fighter wings. TAC loses almost certain loss of at least six wing-and-a-half heavy, two fighter-bomber and three day fighter wings.

Defense Department spokesmen would not say on what basis the future holds for USAF. They said the Air Force must outline its own program when hearings are started on Capitol Hill and then said President Eisenhower's budget message to it is the President's wish.

"The introduction of new equipment and weapons will result greater cost but capability is also being a powerful

impact on concepts of military strategy, tactics and organization.

"The combat power of our divisions, wings and squadrons has increased to such an extent that it is no longer valid to increase military power to twice the number of such units."

## 'Reasonable' Protection

Based on this, apparently the President said he is now convinced the budget provides a "wise and reasonable degree of protection for the nation."

This has followed in the budget that the SAC and TAC fighter wings will be reduced.

The Army's "growing guided missile capability" and the increasing effectiveness of SAC's heavy bombers wing have been cited as reasons for the change. When SAC's B-57 wings are complete, they will have 45 aircraft each. 50% more than the B-36 wings they will replace.

It was made clear that USAF continues in Fiscal 1958 will include very few bombers and possibly no transport, a decision that is certain to change its program for the Douglas C-119 and C-112. These aircraft had been expected to take on much of the log and cargo available to move the Army's thousands of troops and their equipment.

On the subject of USAF's feeling, it was disclosed that about 5700 million of the extra \$900 million could be Congress later in that same year when obligated. But the speedup of the fiscal 1952 production program last year was not enough to fill their needs.

Most of the \$700 million obligated has been applied to the microelectronics and automatic cargo handling machine program. The B-52 speedup was

# Major Expenditures, Obligations

Expenditures by Major Budget Category (Millions of Dollars)

	FY 1953	FY 1957	FY 1958	FY 1959	FY 1967	FY 1968
	(Actual)	(Actual)	(Est.)	(Est.)	(Est.)	(Est.)
<b>Air Force</b>						
Aircraft	4,995	5,974	5,161	4,319	4,766	5,400
Guided Missiles	1,512	200	140	1,792	1,546	780
Electronic & Communications	680	600	614	210	432	597
Production Equip. & Facilities	170	180	187	200	200	24
Research & Development	520	520	520	520	520	520
Operations & Maintenance	4,342	4,342	4,342	4,322	3,790	3,619
<b>Navy</b>						
Aircraft	1,083	1,083	1,421	1,418	1,493	761
Guided Missiles	204	204	190	400	212	228
Electronic & Communications	120	120	120	140	140	121
Production Equip. & Facilities	61	70	60	60	60	39
Research & Development	500	500	500	500	500	500
Operations & Maintenance	2,464	2,464	2,464	2,499	2,499	2,268
<b>Army</b>						
Aircraft	299	299	299	400	400	400
Guided Missiles	207	207	207	415	415	415
Electronic & Communications	120	120	120	120	120	120
Production Equip. & Facilities	60	60	100	120	120	120
Research & Development	400	400	400	400	400	400
Operations & Maintenance	2,671	2,671	2,671	2,622	2,771	2,441

based on a \$347 million supplemental appropriation, the Defense Department said.

## R & D Funds Down

In the critical field of research and development, the Defense budget provides for new obligations of \$1,611 million, down from last year's \$1,794 million.

Again, USAF absorbs the largest share of the slash with a cut to \$651 million from \$712 million. Army is scheduled to get \$400 million, a reduction of \$10 million, while Navy is reduced from \$514 million to \$535 million.

Defense spokesmen pointed out there is a great deal of money going into research and development from other accounts and claim that the appropriation does not provide a good measure of the work done. Bureau R&D frequently includes test and evaluation of new hardware. The report estimates that the total effort in long new weapons in the past of production for the probable will call for almost \$6 million.

Most significant figure for operations and maintenance in the proposed budget is that of the Air Force, which at \$1,212 million in new obligations. The figure is \$822 million more this year.

## Funds For Avionics

The electronics industry will find it difficult to prevent the Defense Department from cutting the budget. It wants, at least, equipment to be included in the proposed figures for aircraft and missiles.

craft and missiles. As a rule, 40 to 50% of missile expenditures are for electronic equipment. In aircraft, the figure ranges from 25 to 30%.

For ground electronic equipment, which would include radar, SAC's air-warning equipment and communications from land-based—the Department total is \$575 million in new obligations, down \$44 million from Fiscal 1958.

Most of this comes from USAF, which allocated \$338 million against \$312 million last year. Navy's figure is \$146 million, down from \$158 million. Army's is \$75 million, or \$10 million less. Navy's is \$146 million, down from \$158 million. Army's is \$75 million, or \$10 million less.

Other highlights from the proposed budget:

• USAF's total budget recommendation.

is \$17,716 million. The Fiscal 1957 estimate for obligations is \$17,600 million. USAF made an early estimate several months ago that it would need to increase by \$10 million.

• Budget provides \$100 million for the Air Force Industrial Fund. This is a revolving capital to put Military Air Transport Service on a "corporate" basis for its new role in single agency for the Defense Department.

• There is no program for military computer research. Funding is provided for a military computer, which is \$75 million, or \$10 million less. Navy's is \$146 million, down from \$158 million. Army's is \$75 million, or \$10 million less.

• Navy will continue with 27 carrier

# Air Power Program

	End FY 1953	End FY 1954	End FY 1955	End FY 1956	21 Dec 1956	End FY 1956
					1956	
<b>Air Force</b>						
Wings	108	110	111	121	126	128*
Aircraft Inventory	75,194	81,491	82,054	78,749	78,814	84,214*
<b>Navy</b>						
Carrier Air Groups	16	16	17	17	17	17
Carrier Airborne Support Squadrons	10	10	10	10	10	10
Carrier Airborne Support Squadrons	3	3	3	3	3	3
Aircraft Inventory	75,300	75,370	75,370	75,370	75,370	75,370
<b>Army</b>						
Artillery Squadrons	114	117	120	122	122	122
Artillery Squadrons	114	117	120	122	122	122
Aircraft Inventory	8,300	8,350	8,350	8,350	8,350	8,351

\* Strength 42, Air Oct 1956, 20, 1956, 21.

\* 422 Civil Air Patrol Planes are being transferred from USAF inventory.

## Defense's 'Third Dimension'

Washington—The Defense Department has now introduced a new "third dimension"—Debt Obligation—into its annual budget presentation.

This third dimension provides figures obtained by adding the new Debt Obligation Authority—the amount reported to Congress in the fiscal year new from last year, except for nonobligations and what is obligated from the sale of military stock.

Result: Defense Obligations are substantially higher than the outlayway sample from of New Obligation Authority and Expenditures. For example, the New Obligation Authority equals in the Fiscal 1958 budget is \$35,500 million. The Debt Obligation will be \$40,994 million. Actual Expenditures are estimated at \$31,000 million.

The Defense Department now believes that the new "third dimension" is the best measure of its budget outlays. Figures compiled by Aviation Week readers as the fiscal year's new Obligation Authority were used in past years as a measure of the contracting possibilities facing the aircraft and electronic industries in the coming year and expenditures which are the best index of deliveries and sales.

air groups and move from 99 to 29 on active reconnaissance squadrons. There is provision to start work on a nuclear-powered carrier and missile ships.

The carrier program will be provided with a nuclear ship. Four new carrier ships will be converted into radar packet ships. About 40 of the 1,200 navy-owned Navy aircraft will be fighter types.

• **Army's Radiation Arsenal**, home of its mobile effort, is not scheduled to receive any specific USAF funds de-

spite the fact that Defense Secretary Charles L. Wilson has said that the Jupiter project will be under Air Force command in 1961-1963. A Defense spokesman suggested that any discussion about it in Wilson's office could be used at Redstone.

• **Marine Corps** will continue to maintain first division and three wings.

• **Work of Atomic Energy Commission** on nuclear facilities will include propulsion units for submarines, surface ships, aircraft and missiles.

## NACA Asks 50% Budget Boost

By Evert Clark

Washington—The National Aeronautics Committee for Aeronautics is asking Congress for \$115.2 million in new authorizations for fiscal 1958—a 50% increase over last year's requests. Four new aerospace research facilities and a 10% increase in personnel are included.

Construction requests total \$44 million—nearly three times the \$14 million requested for fiscal 1957.

NACA's budget reflects the great emphasis its laboratories are putting on the problems of aircraft and missile flight at very high speeds and transonic ranges.

**Langley**

Langley Aeronautical Laboratory at Langley, Va., is seeking authority for a new research plane, Test Area—34, \$57,000. This would include major facilities for high engineers and low speeds, high and low altitudes, solid and liquid fuel rocket test cells for velocities up to Mach 20 and above, a propeller test cell, downward jet, jetting temperatures up to about 11,000 deg. F. for research on effects of light weight, high thrust and short duration, and hypersonic jets for research relating to specific characteristics and shock interaction problems.

• **Hypersonic Helium Bombardment Tunnel**, \$750,000. This closed orifice tunnel, 12 to 13 in. in test section, would cover a range from Mach 10 to 25.

It is needed for research on satellite and missile problems that will be encountered in flight after take-off or reentry. NACA and its wind tunnel is available for Mach numbers above about 10, and is not suited for speeds above about Mach 24 or at Mach 10, because of the velocity pressure in the test section.

• **High Speed Tunnel for Gun Test—\$750,000.** This new gun tunnel, at the fiscal 1957 budget, would cover two high speed tunnels, a range from Mach 10 to 16.

• **Data Reduction Center—\$3,607,200.** NACA is now asking for authority to build this facility but is not asking for the funds.

• **Modification of the 26 in. transonic tunnel** to provide an alternate test section and extend the Mach range down 3.4 to 4. This is necessary to study compressible flow problems. Cost would be \$346,000.

**Ames**

Ames Aeronautical Laboratory, Moffett Field, Calif., is seeking authorization for a number of projects, including:

• **Hypersonic Tunnel—\$11,710,000.** This tunnel, with a 3.5 ft. test section, would cover a range from Mach 5 to 10. The test section could be large enough to allow scale duplicate of aircraft structural components for studies on heating and other aerodynamic problems.

• **Byram system** for the use-to-test test section test section of the Union Test Tunnel that would increase

the Mach number from 2.55 to 3.6; Cost, \$100,000.

• **Boundary layer research** in the 14 ft. transonic tunnel, increasing Mach number from 1.2 to 1.4 and eliminating of model size. Cost, \$4,435,000.

• **Flow improvement of the 11 ft. transonic tunnel** of the Union Test Tunnel by altering the method of testing the flow section and changing the bypass air entry at the downstream end. Cost, \$155,000.

**Lewis**

Lewis Flight Propulsion Laboratory, Cleveland, Ohio, is asking authority for:

• **Rocket System Research Facility—\$7.5 million.** This would include two new buildings and modifications of another; research stands, cells, and laboratories for research on rocket system.

• **Expansion of Propulsion Systems Laboratory—\$1.5 million.** This would include installation of equipment to improve performance of engines in excess of Mach 4.5 and permit more extensive use of high energy fuels in rocket motors.

• **Modifications to component research facility** for nuclear propulsion—\$5,015,000. This would include a hot laboratory for handling and investigation of nuclear components and a laboratory for nuclear components to determine damage to components.

Lewis also is asking authority to add 115 new to its personnel.

**Wallops Island**

Wallops Aerial Research Station at Wallops Island, Va., wants \$24.5 million for modernization of facilities and equipment, including:

• **High speed range**, including a hot wind tunnel to test rocket engines, a new tracking radar, telemetry receiving equipment and an increased range Doppler system.

## CAA Asks 57% Boost To Push Airway Plan

A second \$115 million was requested for the Civil Aeronautics Administration for fiscal 1958—a 57% increase over 1957.

President Eisenhower placed major emphasis on his budget message upon the need for increasing the capacity of the air traffic control system, and the \$114.5 million requested for an air-traffic facilities was almost lost when the original fiscal 1957 budget request. Subsequently, however, the figure was raised and Congress approved a total of \$75 million.

CIA's budget request includes funds for 10 aerial search detection systems (ASDS) including "new radar" which could, under certain conditions, be used whether distant enemies and

## Civil Aviation

New Funds  
(in Millions)

	FY 1954	FY 1957	FY 1958 (Estimated)
<b>CAA TOTAL</b>	<b>170</b>	<b>280</b>	<b>340</b>
<b>Administration Operations:</b>			
Federal Airways	10.5	12.0	12.0
Flight Operations and Airworthiness	4.7	14.0	14.0
Airports	2.5	3.0	3.0
Establishment of Air Navigation Facilities	22	76	107
Aircraft Development	1.0	1.0	1.0
Air Navigation Equipment	1.0	1.0	1.0
<b>Grants:</b>			
Administration	66.5	76.0	87.0
Payments to Air Carriers	10.0	10.0	10.0

new ships in adverse weather are also of benefit.

### New Navigation Aids

New navigation and terminal aids are in the proposed budget:

• **137 VORTAC stations**, 560 have been installed or previously authorized.

• **83 VORTAC stations**, 175 installed or previously authorized.

• **50 ILS instrument landing systems**, 170 installed or previously authorized.

• **21 Low-range radar** for enroute traffic control, 32 installed or previously authorized.

• **20 Air traffic control beacon systems**, 15 installed or previously authorized.

• **64 Radar approach lights**, 18 installed or previously authorized.

• **32 Sequenced flashing approach lights**, 5 installed or previously authorized.

• **12 Airport traffic control towers**, 31 installed or previously authorized.

The budget does not seek any additional personnel approach needs (PAB) to implement the 21 systems already authorized or authorized.

A supplemental appropriation of \$20 million will be requested for 1957 to "cover the cost of integrating two existing, short-range navigation systems into a single system capable of carrying the navigational needs of more than six times," the President said. He had reference to the VORTAC system which was integrated last September by the Air Commanding Committee on its decision on the controversial Texas issue.

The President recommended an appropriation of \$195 million to acquire and upgrade the fiscal 1958, a 40% increase over the \$139.5 million requested for fiscal 1957.

It was estimated that an appropriation of \$35 million will be required in

fiscal 1958 to meet obligations incurred under the contract authorized provided under the government program for airports. A total of \$23.5 million has been authorized for fiscal year 1958 through 1959 under the amended Federal Airport Act.

### New Washington Airport

Eisenhower also supported there, Va., in a liquid act for an alternate airport in the Washington area and said a supplemental appropriation of \$15 million will be requested for fiscal 1957 to cover construction of the new airport.

Airport use changes were advocated by the President, who said "government aid to aviation directly enhances national benefits upon the men of air space. At the cost of these benefits, air, it becomes a serious threat to the general public in a private law."

Airline in the past have expressed a willingness to absorb their share of airport costs but have held that times past by the airlines are equivalent to cost changes.

The Board's program for the coming fiscal year calls for increased spending on all of its fields of activity. Spending for commercial aviation is scheduled to amount from \$2,532,000 in fiscal 1957 to \$1,310,000 in fiscal 1958, spending for other aviation will increase from \$145,000 to \$168,500, for medical investigation and aviation from \$681,000 to \$166,700, for legal staff activities from \$157,000 to \$465,000, for executive direction from \$299,000 to \$194,000, and for administrative and service activities from \$444,000 to \$197,700.

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### XB-68 Canceled

Washington—The Air Force has canceled the Phase II prototype of the Martin XB-68 bomber but will continue to finance new design studies on a low priority basis.

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An Aeronautics Development Board will emphasize air traffic control and development and a \$2 million approval program was requested for its work during fiscal year 1958 compared to \$1.5 million in fiscal 1957.

In his budget message, the President called for a \$10 million appropriation for the CAA. However, this amount excludes the \$63 million contract authorization for airports but \$15 and less appropriation used to liquidate the contract authorization.

### CAB Budget

Civil Aeronautics Board's budget request for fiscal 1958 provides for substantial increases in the Board's staff and in the amount of appropriations for airline subsidy.

CAB wants to increase its budget for airlines and expenses from \$4,615,000 in the current fiscal year to \$5,753,000 for fiscal 1958.

The Board's staff from the 625 employees authorized this year to 758 in the coming fiscal year.

CAB's subsidy request for fiscal 1958 is increased sharply from the abnormally low fiscal 1957 level of \$16.2 million to a total of \$51,010,000 for next year. The annual level of subsidy paid to the airlines remains constant at about \$47 million.

The difference between 1957 and 1958 subsidy appropriations is due to the fact that CAB had a substantial increase from 1956 to help pay the fiscal 1957 subsidy bill.

The Board's subsidy request for fiscal 1958 total includes \$4,124,000 which CAB has asked which was not covered by the current \$16.2 million appropriation.

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## National Advisory Committee

### For Aeronautics

(in Millions)

	FY 1954	FY 1957	FY 1958
		Est.	Est.
<b>General Operating Expenses</b>	40.1	44.1	76.4
<b>Construction</b>	10.0	10.0	10.0
<b>Leasing</b>	3.0	7.4	4.0
<b>Assets</b>	1.0	1.0	1.0
<b>Research</b>	1.0	1.0	1.0
<b>Flights Aircraft Division</b>	1.0	1.0	1.0

## Macmillan Government Slashes Defense Funds; Air Force Suffers

London—Part of an anticipated year of defense slashes has been announced by the Macmillan government, with the major portion of the cut, an estimated \$15 billion, coming out of military funds.

Least cutback announced is the cancellation of orders for 180 Hawker Hunter fighters. The Ministry of Supply says the cut was due to a "rebalancing in RAF requirements." Financial saving is expected to be some \$15-million.

The replacement Hunter is the Sea Hawk fighter of the Royal Air Force. Although a spokesman for the Air Ministry and there is no dissatisfaction with the Hunter, some quarters regard it as an obsolescent aircraft in view of more advanced fighters now in operational service with the U.S. and Russian air arms.

The aircraft succeeded one of the latest V-bombers.

### Way to Come

The cut is regarded as the first of a number which can be expected as the Macmillan government seeks out a new role for Britain in world affairs and thus tackles the task of keeping some order out of the present chaos in British military aviation.

The Defense Ministry also announced that Britain's new "rocket war machine" are being disbanded. The units will double the Royal Air Force's Air Force and Royal Navy Volunteer Res-

erve Air Branch. The saving is expected to total nearly \$17-million.

The RAF's Auxiliary includes 20 fighter squadrons and the Navy Air Branch includes 11 fighter and attack squadrons.

In addition to their economies in the aviation field, the War Office announced there will be no savings of other reserves for post-bomb training forces.

Target date for debanking the RAF and navy reserve cut came on March 18. Flying schools has closed and the remaining force will be devoted to administrative winging. A side effect of the action is expected to be a saving of \$7 million per year from fuel—a price—a important factor of the cost in a full-scale Britain.

Minors of the 20 fighter squadrons in the RAF Auxiliary has been to supplement Britain's defenses against an attack, other than high-altitude nuclear attack. The squadrons have been flying Mustang and Vampire. It was decided some months ago that there would be no program to equip the squadrons with the more modern Hunters.

Technical development is continuing involving the new that the new threat to this country is from high-altitude attack. The Air Ministry, says, "other kinds of attack, which might be considered by less advanced types of aircraft are, in consequence, less likely to materialize."

The small reserve units have been flying Mustang, Mustang, Mustang and Mustang. The Ministry says the new debanking the squadrons was necessary "to ensure the replacement and re-equipment of the fleet in a short while, the kind... which can economies can find."

An Air Ministry spokesman offered to comment on what further cuts in British aircraft production are in the offing. He said the war's defense outlays were not under pressure.

The recent change in government makes it impossible to predict in detail what future defense cuts can take but it is known that the Macmillan government feels that Britain in the past has been overcommitted in terms of her economic ability to bear the military burden.

### Technical Switch

Emphasis of the new government on improving the nation's industrial position also is expected to force defense of materials and technology from defense programs into general industry. This could mean a cutback in research and development funding in many fields.

Some political observers believe the new government will work out a longer policy on the lines that the United Kingdom never again will "go it alone" as it did in the past. Such a policy obviously would eliminate the necessity the military forces capable of "going it alone" and permit a substantial cut in defense spending.

While this would look like for general high production throughout the British armaments industry, it could result in a much higher, and in the long run more

effective, efficient and guided missile program.

One of the most important changes in Prime Minister Macmillan's cabinet (also) was the appointment of Duncan Sandys to the post of Defense Minister. He is regarded as one of the "right wing" men in the Conservative Party, and undoubtedly will not miss a chance to make a name for himself as a field which is wide open for effective action.

Expansion of Britain's V-bomber force is expected to continue, with added emphasis on development of a supersonic interceptor for defense. Increased dependence on the U.S. for

guided missile development can be expected.

Contact of the Hawker Hunter also may mean increasing confidence in the English Electric supersonic F1 fighter which is scheduled to succeed it. A production order already has been placed for the fighter. Hunter still is developing a supersonic fighter with its own hands.

The cut in British aircraft spending also could fund other cooperation with the U.S. in the field of military aviation. Britain often has been criticized for latching on to U.S. developments. If the two nations take

on complementary roles in the attack and guided missile fields, much of the duplication and its resulting financial waste could be avoided.

Armstrong Whitworth Aircraft firm, which produces the Hunter together with the Hawk and Jetstream, already has announced a new division, between 500 and 600 skilled workers. A spokesman for the company says some of its contracts were cancelled last but that the firm's requirements have "settled."

Despite the layoffs, the firm is increasing since 100 technicians for guided missile research and for development of its new fighter aircraft.



Snark on launchers shows way to be for fast launching order during in Aviation Work (AW) No. 26, p. 46. Launcher is zero-length type and is in transportable in British C-141 Globemaster. Two rocket launchers have needed months to erect first thrust through Snark control of gravity to maintain discrepancy.

## Snark to Become Operational With SAC

Northrop's SM-62 Snark autonomous missile program has been scheduled to become operational in a limited form with units of Strategic Air Command in about one year.

Acceptance of the Snark, to augment the striking power of SAC, gives more units to the fleetable for service use of the long-range ballistic missile—Couster Atlas, Minuteman Titan and Douglas Thor—now under development and nearing the flight stage.

Pre-production quantities of Snark have been built at Northrop's Hawthorne, Calif. plant for at least six years, along with the ground support equipment. Availability of the missile, which cruises at high subsonic speed and is controlled by a Northrop-

developed hybrid inertial guidance system, figured into the Air Force decision.

Official details just released of some of the Snark's characteristics confirm in almost every respect an earlier engineering analysis of the autonomous guided missile published in Aviation Week May 25, p. 46.

Snarks will be launched from a zero-length launcher, which is an instrument able. The launchers are towed by a tractor or ball-truck, power mover and target the Snark missile to that up to 100 ft. The missile is launched on a track that runs on the ground over a concrete launching rail. With these launchers set up at a single site, 30 Snarks can be launched and fired during a 14-hr. period.

Length of the launcher is 29 ft., width 10 ft., and its extended length is seven feet. Systems three-foot diameter has been the height.

At launching, the Thor & Whitby J17 (weight in development) left throat and a pair of rockets boost the Snark off the launcher. The thrust thrust accelerates the bird to 1000 mph and Snark, which is a high altitude for as much as 0.9 hr. Near the target it pulls out into a dive and aims into the target at supersonic speed.

It can carry any 100-lb. warhead, including nuclear charge, over a range limited in the 5,000-mi. class.

Dimensions of the Snark overall length, 69 ft.; wingspan, 42 ft.; overall height, 15 ft.



### F-104A's Spiked Intakes

First officially released picture showing Lockheed F-104A supersonic intake confirms in every detail its exclusive Aviation Week Action published earlier (AW Aug. 24, 1964, p. 10). Lockheed's Colleton-Dennis is now producing the F-104A, and its prototype, the F-104B. The "A" version is scheduled to join Air Defense Command squadrons in the near future. Plans are planned by the General Electric J79 turbojet that aircraft must be modified to handle high speed and high altitude (AW Dec. 24, p. 32). F-104As measure 54 ft. 9 in. overall length, 15 ft. 6 in. high and has wingspan of 21 ft. 11 in.



Leduc 022 on the ground shows the large size of its swept powerplant which makes up entire half of airplane.

## Leduc 022 Prepared for Tests Aimed

By David A. Anderson

Rene Leduc's 022, swept-powered supersonic interceptor designed for performance in the Mach 2 region, is being readied for a series of flight tests at Mach numbers approaching 4.0. Tests in the high supersonic Mach range are planned for next month. Specifically, the jet is going after a 4,000 km/hr mark, equivalent to 2.467 mph.

Should the record attempt be successful, they will stand as high points in the almost single-headed efforts of Rene Leduc to establish the aircraft as a piloted aircraft powerplant.

### Flying Powerplant

The Leduc 022 is a flying engine, like its predecessors. Its basic power-

plant is a swept engine more than 6 ft in diameter and about 70 ft long. Translating its design thrust at 4,000 km/hr is an equivalent sea-level static thrust would rate the engine at 112,000 lb.

In addition, there is a Suezor Air turbojet mounted under the swept body to provide power for takeoff and acceleration to supersonic speed. Not much a swept engine's velocity, some where around Mach 0.4 to light off and burn successfully.

Core weight of the 022 is 13,100 lb., of which about one third is fuel. Wing and tail surfaces are swept back, approx. match 35 degrees. Overall length of the 022 is about 50 ft and it stands about 17 ft high in the nose-pilot attitude.

Last prototype 022 was completed in June 1956 and has been on flight

status for several months. Second should be almost completed.

### Leduc History

Rene Leduc has been working on swept-powered aircraft for 24 years. The first proposal dates back to 1932; it showed an airplane basically the same as his current 022, a swept (swept) powerplant with a cockpit in the nose section. A model of this aircraft was shown at the Paris Show in 1938.

In 1935 Leduc's experiments bore fruit: an experimental swept jet developed positive thrust in a nose-on position.

In January, 1936, Leduc presented some of the conclusions of his experiments in a note to the Academie des Sciences. In April he gave a public



Leduc 022 looks away during flight, but at French air force center at Mire. Plane, which has been flying several months, is a flying engine with a large powerplant consisting of a swept more than 6 ft in diameter and about 70 ft long.



TAKEOFF powerplant is Suezor Air.

## at Mach 4.0

Leduc under the sponsorship of the Service de Navigation Aerienne. In June of that year, he had obtained 1000 km/hr, but in his aircraft had completed a service test on the engine.

The French Air Ministry, through its Technical Service, ordered the 010 in an experimental airplane in 1947 and Leduc began construction. The following year he took over a section of the Bugatti factory in Paris and started model tests with the complete aircraft wings and the powerplant.

### Dodging Germans

Defence work was made in 1935 but the work was interrupted by the German invasion of 1940. A year later Leduc fled the parts off to Toulouse and started to pressure the Vichy government to allow further effort on the project. This order was given in 1941.

It was that year the Toulouse works were bombed in 1941 and the shop and the materials were destroyed.

In August 1944 France was liberated. Leduc built a new plant and started all over again on the 010, which was completed the following year. Development of the supporting system for its launching the 010 took more time and it was not until November 1946 that necessary preliminary tests could be made.

Captain flights followed with the 010 suspended above a Laupadine carrier aircraft in a structure of steel. Some photo tests were added in the program to get a general idea of the handling characteristics before testing on the jet.

### First Test-Up

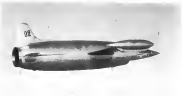
After two and one-half years of preliminary work, the first powered flight was made in April 1949. The carrier went into a shallow dive from 15,000 ft. and at 10,000 ft. the pilot of the



Leduc 010 was first swept-powered supersonic airplane, served in test vehicle, made first flight in April 1949, from supersonic system like that above on Laupadine.



Leduc 022 powerplant shows its distinctive shape in this rear view of plane. Speeds in the order of Mach 4.0 were reached during flight tests.



Leduc 021 in flight did much development work for current 022 intercepter model. Air plane exhibited a mark of 15,700 rpm rate of climb at altitude of 30,000 ft.

018 cut in the harness. The engine fired, and he separated from the car.

During the drop, the pilot cut in additional harness—which was zoned in that airplane to give some measure of thrust control—and pushed up the speed to about 450 mph. Flight duration was about six minutes.

In later flights, the 018 reached a speed of over 500 mph at 36,000 ft. At that altitude, the rate of climb was 3,000 fpm, a figure still most impressive.

Three prototypes of the 010 were completed. The second was a duplicate of the first; the third was equipped with turbofan engines mounted at the wingtips for cruise and landing operations.

French Air Museum support continued with the only for a pair of Lodig 021 aircraft, larger and with greatly improved performance over the 010 too.

First flight of the first 021 was in May 1955.

Like their ancestor, the 021s were

crossed braced from a midline airplane bearing a suspension system much like the one used for the 010.

The 021s were subsequent, speeds on the order of Mach 0.9 were reached during flight tests. Estimated sea level rate of climb was close to 40,000 fpm. At 36,000 ft the plane established a climb rate of 15,700 fpm rate of climb. Climb was calculated to be on the order of 55,000 ft.

The 021 prototypes currently are being used to develop components for the F22 intercepter.

## Bomber Defense Missile Uses Hawk



**BOMBER DEFENSE MISSILE VEHICLE** is first test vehicle pattern is adaptation of the Skyhawk Hawk. Layout conforms earlier report of Hawk configurations (AW Dec. 30, p. 21). Overall length of Hawk is about 40 ft., and diameter is about nine inches. Long delta wings appear to be composite cast surface and are bolted to the fuselage as a skin connection. Tail section is fixed and not maneuverable in forward position, but is given space for linear outboard bearings located 90 degrees apart around periphery of rocket motor nozzle. Spacing of bearings suggests this section strong support. Note markings of low angles positive identification of angles position in roll during test flights.

Cornell Aeronautical Laboratory has been designated systems engineering manager for an Air Force bomber defense missile (BDM) system based on the test vehicle adapted from the Skyhawk Hawk.

The Hawk, an anti-aircraft missile under development by Raytheon for Army Ordnance through its Redstone missile program, was used for tests of the Cornell-developed bomber defense missile. First stage of BDM vehicle has been made from rocket-propelled sled at the Holloman Air Development Center.

This action is the latest in a series of self-defense research that have characterized the BDM program since its inception. Previous action occurred late last year when Air Force issued shop orders on two contracts first under the (AW Nov. 5, p. 24).

At this time re-evaluation of the entire BDM program was being done for the Air Command. Affected in the order was two technical teams: Republic Aviation Corp. plus Westinghouse, and General Electric Co. plus McDonnell.

Republic has since secured a transmission order on its contract.

The present Air Force program is now for an intercept, although much smaller in scale to its ballistic missile approach. Cornell is the counterpart of Ramo-Wooldridge and has been in systems engineering manager for the BDM.

Cornell is providing engineering assistance to the Air Force just as Ramo-Wooldridge advances the Western Development Division.

### New Navy Trainer

Washington-North American T-2F jet trainer is about to go into production for Navy use. T-2F will be powered by the 3,400 hp, turbo Washington (T4) engine.

First delivery is expected in December.



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## Hughes Aircraft Unveils Two Place Helicopter for Military Use

By Irving Stone

Culver City, Calif.—Hughes Aircraft Co.'s Assault Division unveiled its new two-place Model 269 helicopter in a series of flight demonstrations last week. The craft previously had been flight demonstrated for high ranking military personnel (AV Dec. 24, 1956, p. 17).

Designed to provide a simple, light weight, rugged and economical configuration, the Model 269 has been developed by Hughes in anticipation of a military requirement for an optimum size two-place copter.

The utility, rugged aircraft has been flown by eleven Army evaluation test pilots.

### Military Orders

Hughes officials will make no comment on possible military orders, but Aviation Week has learned that Army interest has progressed to the point of processing an order for an evaluation quantity—5 to 10 of the copters. Four of these machines probably will be delivered to the Army Aviation Board at Ft. Rucker, Ala., late this year.

While slated initially for military applications, the copter will be offered to government agencies such as police, fire, customs, and highway engineering departments, and to a wide field of industrial activities. Estimated cost also encompasses the 300th vehicle, a \$110,000—relatively low figure.

The copter has been designed for a normal gross of 1,500 lb. This would be equipped of 800 lb. empty weight, 140 lb. fuel, 100 lb. baggage and 400 lb. for pilot and passenger. At an overload gross weight of 1,750 lb., payload is limited to 350 lb. The copter already has proved out of ground effect at the 1,750 lb., figure.

Top speed is 93 mph. Cruising speed is 75 mph. Range with maximum load (400 lb.) and 350 lb. of equipment is 179 mi., or 21 hr.

The Model 269 features open steel-tube construction. Engine is a 170 hp. 4-cylinder, air-cooled, featuring 0.445 A/F ratio is secured in place before the seat structure with four bolts. The engine provides ample power for cruising at reduced engine loads and for hovering at high altitude or on hot days.

Single main rotor, 21 ft. in diameter has three fully articulated all-metal blades. Blades have a U-shaped nose extension, which is in effect the main structural component. The U-shape resists the elements and is joined at the trailing edge over external filler.

There are no ribs in the rotor blade. Configuration of the blades, a straight line, not to try, but Hughes is holding an experimental version of a twisted blade for the rotor, to improve hovering and forward speed capability.

Engine dampers instead of hydraulic dampers are used in the rotor hub.

The engine is connected to the main rotor by a single drive with a series of seven belts. Half of these belts can be lost and full power can still be transmitted. If continuing belts prove out the desirability of the belt drive it will be built in a design feature.

An inter-pulley located between the engine and gearbox pulleys serves as a manual check to engage or disengage the engine to the gearbox. Based on the gearbox pulley is an inter-pulley which automatically disengages the rotor from the engine, to permit rotor rotation.

### Shock Struts

The shock-type undercarriage carries four shock absorbers (two on each side) which allows better control of the machine when contacting the ground and enables for other sets optional track devices.

Lift-off is made by a single rotor and transmits to a tail rotor just before the tail rotor. Just forward of the tail is a fixed horizontal stabilizer.

Easy maintenance has been stressed in the design. The rotor system (hub and blades) engine and gearbox can be removed without disturbing either of the other parts.

Estimated ground level is now as-

### Model 269 Specifications

Main rotor	fully-developed, all metal
Blade	25 ft. dia.
Articulation	Open steel tube construction
Engine	Four-cylinder, 170 hp. air-cooled, featuring 0.445 A/F
Empty weight	140 lb.
Useful load	500 lb.
Gross weight	1,750 lb.
Dimensions	41 ft. high, 19 ft. 5 in. long
High speed	93 mph
Cruising speed	75 mph
Cruising range	179 mi.
Normal endurance	21 hr. (15 hp. fuel capacity)
Rate of climb, on level	1,400 ft./min.



First picture of Hughes Model 269 jets engine in power flight at the Culver City, Calif., plant. One-hour two-man vehicle is 51 ft. high, weighs 150 lb. empty, has a cruising range of 170 mi. at 75 mph. Engine is 4-cylinder, air-cooled 170 hp. 4-cylinder.

designed to establish component reliability. Hughes is aiming at 1,000 life for components such as blades and gearbox.

The flight program also is continuing. About 50 hr. of flight time have been scheduled up over the copter first five in October last year.

## Martin P6M Escape Systems Evaluated

Wichita, Kan.—Boeing Aircraft Corp. will evaluate emergency escape systems for the Navy Martin P6M SeaMaster to determine whether dynamic factors at the front of operation at high speeds are within the limits of human tolerance.

Under subcontract to the Glenn L. Martin Co., Boeing will mount an aerodynamic dynamic bench for operation from Navy's supersonic rocket sled at the Naval Ordnance Test Station, China Lake, Calif.

In the crash of the second XP6M-1 SeaMaster (AW No. 38, a P6) last Martin company ejected safely, seconds after the plane went into a tight spiral loop at Mach 5.8. It had slowed from a higher speed.

The engineering research program on the escape system is not a result of other SeaMaster work, having been planned before they occurred.

## Convair Division Receives New F-102A Contract

Convair Division of General Dynamics Corp. has received its fifth Air Force contract for supersonic, all-weather F-102As. New contract totals \$74 million. Two USAF fighter-escort squadrons are now flying F-102As.

# AIR TRANSPORT



BOAC hangar at London Airport, north largest of its type, has total floor space of 17 acres. Concrete, reinforced structure houses four large hangars accommodating total of 12 Stratosmeared aircraft also modern offices.

## BOAC Seeks All-British Turbine Fleet

DC-7C Atlantic service begun in stop-gap attempt to recover traffic lost after grounding of Conquets.

By L. L. Doty

London—British Overseas Airways Corp. has embarked upon a stop-gap route program designed to give it an all turbine fleet by 1960 and an all British fleet by 1962.

The long-range equipment plan got under way under this scheme with the replacement of DC-7C service on BOAC's Winter route. But DC-7C, however, has looked upon as only a stop-gap measure.

That chief purpose is to give BOAC an equipment to replace some of the traffic lost by other carriers when the grounding of the Comet I in 1954 left the company with an odd assortment of aircraft scattered in the highly competitive transatlantic market.

### Program Highlights

The overall program was organized in 1956 to keep pace of which is pattern using British-made aircraft while leaving no one in the race for international mail travel business. Some of its highlights:

- Bristol Britannia 102 service to South Africa will be reorganized on Feb. 1. Britannia schedule to Australia will be introduced in March. India service will start in June. In August, Bombay-Colombo-Singapore service will begin, and Singapore-Hong Kong service via Calcutta will get under way in September. The Britannia schedule will be increased, the following year in more experience and aircraft utilization is added. By that time the 15 Britannia

102s-10 have been delivered to date will enable BOAC to cover all its current routes with British aircraft, leaving pattern regular places for other services as customers to flights.

• Comet IV service will start early in 1959, replacing the Britannia on the Australia run. Four months later, Comet will take over all the London routes and the all-British fleet will replace British-made aircraft on the East and West Indies routes. That stage in the Comet program will be introduction of the Britannia on the South Africa route in July, by the end of 1959, BOAC will have an all turbine service in the British Home region. Newcomer Comet IV's have been ordered by the airline.

• In the Western Hemisphere, DC-7Cs will operate as toward will transport that class on European flights while the Boeing 377 Stratosmeared will handle all first class traffic. IAW Jan. 14, p. 47.

• Future world DC-7C flights will begin in April to San Francisco where around the world connections will be made with Eastern Europe service.

• Britannia 102 operations will replace the Stratosmeared on the Atlantic route following delivery of the new long-range transport about mid-1957. The airline can determine when date in implementing the service because of the new pilot shortage in England (IAW Jan. 7, p. 45). BOAC has 15 of the 30s in order.

• DC-7Cs eventually will be able to obtain delivery to help pay for the 377 Boeing 707 jet transports the airline

has on order with deliveries beginning in 1960. The 707 will replace the DC-7Cs on the Atlantic run, giving the airline complete turbine coverage on all its routes.

• The de Havilland 116, now in the design stage is expected to make its first flight in 1962. This airplane, proposed by British Overseas Airways, is just designed will ultimately replace both the Comet IV and the Boeing 707 to provide BOAC with an all-British fleet.

### Comet I Setback

The airline never fully recovered from losses suffered when its jet super-jet was grounded in an attempt to deal with the grounding of the Comet I. With 21 Argentina, 45 Constellation



BASIL SMALLPIECE, BOAC managing director, believes new jets will not present great problems.

790s and 18 Stratosmeared to cover some 55,000 miles of international routes, BOAC has been without sufficient available aeroplanes and the long-range aircraft needed to compete with the more modern equipment of its competitors.

Despite the equipment setback, the airline has turned a profit in each of the past two years. In the fiscal year ending last March, the accumulated deficit was erased and a surplus was recorded for the first time in company history. This was due in part to the sale of spare and other assets.

Despite this, BOAC Chairman Gerald d'Almeida has not been optimistic over BOAC 1957 results. Last spring, he warned that the company faced a possible 34 million deficit this year. However, the improved traffic situation during the year probably will offset at least some of the heavy expenses incurred by the introduction of the DC-7C and the Britannia.

### Load Factors Dip

Load factors dipped from 63.7% in April 1955 to 61% last year. And although variable, no airline increased 21% in fiscal 1956, this left short of the expected BOAC had forecast for 1956. Carrier operations by 9%.

Chartered equipment helped account for the increase in available tonnage as well as the 37% jump in the number of passengers carried. But revenues rose only 20% because of the higher percentage of international traffic flown last year. In fiscal 1956, 71% of the airline's customary revenue came as compared with 65% for the previous year.

BOAC's operation of the Comet I between May 1952 and April 1954 produced at least one major long-range factor-out gave the airline a practical halving of expenses that some of its competitors missed. BOAC flew some 24,000 hours in scheduled service and carried close to 55,000 passengers during Comet I service. A series II Comet will be delivered shortly to provide additional operating experience with passengers. Early trials find Smallpiece, BOAC managing director, last month that "our experience with the Comet I taught us that, whereas past jet aircraft demand the application of new techniques, these operations don't present any very great problems."

### Plane-Out Solution

The airline was threatened last September with another disappointing result in its equipment program when the Britannia's turbine engines developed flame-out troubles caused by the formation of ice crystals in a case in which data under certain weather conditions. Careful handling by crew from the

safty of the airline encouraged the flame-out, or all, of the combustion chambers.

Last month, flame-out experience with the Bristol Aircraft Establishment at Farnborough, the National Civil Airline Establishment and BOAC—apparently solved the flame-out problem in a combination of the flame tubes of the Proteus engines. Three test flights under severe icing conditions have demonstrated the effectiveness of the modification.

Capt. H. D. Blomfield, BOAC deputy operations director, told Aviation Week: "The flame-out danger was resolved in two steps. The first was the modification of the Proteus engine, the second that the engines have a possible 34 million deficit this year. However, the improved traffic situation during the year probably will offset at least some of the heavy expenses incurred by the introduction of the DC-7C and the Britannia."

The second measure was decided upon after viewing the flame-out tubes by television while the engine was in operation. It was observed that the bird-like seemed most susceptible in the flame-tube transfer or crossover

angles in the start and light positions. As a result, lightning in ballies cornered of an alloy metal have been fitted to the flange to deflect the ice particles away from the flame tubes.

### Britannia Schedule

More than 7,500 hours flying time have been accumulated in Britannia testing and training with BOAC accounting for more than 3,570 hours of the amount. The Proteus engines have completed 55,000 hours of development operation. The engine develops 4,130 total equivalent horsepower or 3,653 hp, plus 3,220 hp thrust.

The Britannia service scheduled to begin on Feb. 3 will be operated three times weekly between London and Johannesburg. The new-class configuration will include 19 first-class diametric seats (half reclining seats with foot rest) in the rear of the cabin and 40 tourist seats in the forward section. The flights will serve Rome, Khartoum, Nairobi and Salisbury.

London-Spiny service will begin in



NEWEST BOAC PLANE, the Douglas DC-7C, shown, now in transatlantic service, and Bristol Britannia 102, below, scheduled for London-Johannesburg service next month.



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DETROIT—one stop to Los Angeles

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## CONCLUSIONS



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tern which would have a width of 14 ft 8 in at floor level. Otherwise identical with the 150 series, it will carry six cars and 78 passengers on short and medium routes.

High speed wing of the freightliner will be light alloy two part construction with double doors. These will be hydraulically operated. Gross wing size is 1,495 by 41 ft. Conventional ladder, elevator and stairs are operated by tension-controlled cables and move down from the consolidation of Route 47 and Route 3. Eastern will be occupied from spending a secondary area between New York and Chesham. W. Va., and the owner's request to service Cincinnati on the New York. St. Louis route was denied.

Retractable trailer endosmogs are sold, tested, operated by hydraulic jacks. Most models attach permanently into every engine model. Hydraulic hoses with quick couplers allow for quick disconnection.

The CAU decided to lift a restriction that currently prohibits IWA from operating in Washington state. The Board also voted to rescind a restriction from American's authority in the future will be able to operate showing lights between Los Angeles and Washington.

lowing interspecific pollinated range class averages with reserves: 900 statute miles at 25,000 lb., 1,000 mi. at 25,500 lb., 1,500 mi. at 27,000 lb., 2,000 mi. at 27,500 lb.

## CAB Reclaims Subsidy For Pacific Operations

Washington—The Civil Aeronautics Board has proposed new temporary mail rates for Northwest Airlines and Pan American World Airways' 1964 transpacific operations that call for the

## Examiners Choose 31 Irregulars

Washington-Durham of Civil Liberties Board have recommended that 51 of the 54 applicants in the Long Inquiry Case be authorized to receive a supplemental air permit.

The report by economists Ralph L. Winer and Richard A. Walsh deals only with the qualifications of the individual applicants and is one of the final steps in the long, complicated case. The CAB made its general policy decision at the end of November 1955.

Judging the qualifications of the applicants, the committee applied a financial standard which depended heavily upon "going concern status," evidenced by current operations, although this accepted certain other proof of operational and financial ability.

If the CAB follows its executive's recommendations, it will leave the two supplemental inland ecosystems at about equal strength. All 11 members

two carriers to surrender \$7,542,000 in rebates for this period.

The CAB has been working on final fuel rates for the two phases' 1994 profile operations for first year and the new temporary rates are designed to cover out their breakeven level until final rates are set.

Northwest universal mail pan totaling \$4,911,800 for its 1974 international operations, including \$1,474,000 in receiver mail pan and \$3,437,800 in sales. The C&B finds Northwest's booklets need for period was \$3,607,800 and set the new temporary rate at that level, leaving an overpayment of \$1,400,000.

During 1998, Pan American received service mail pay of \$7,466,000 and \$5,916,000 in subsidy for its Pacific operations. Pan American's Pacific Division reported a \$4,755,000 profit for the year, a 15.89% return on the nation's Pacific operations.

The Board finds that Pan American's Pacific break-even need for 1991 was \$1,134,000, an amount covered by the \$1,466,000 received as service mail pay. Thus the CAB proposed to put Pan American's Pacific operations on a new temporary mail rate which is the same as the service mail rate for 1991.

The CAR figures that without the \$5,916,800 subsidy paid to 1974, but with the \$3,087,800 income tax credits related to the subsidy return, Pan American will still have a profit of \$1,769,000 for its Pacific operations in 1974, a 6.21% return on investment.

of the Independent Military Air Transport Assn. were approved as the report, and 15 members of the Airworth Transport Assn. received the approval of the committee.

With new varietals, the committee recommended that the CAB issue its recommendations to carrier authority to the line Transport Carriers, All-American Airways, American Flyers Airline Corp., Air Pacific, Agouti Airways Corp., Associated Air Transport, Airborne Corp. of Seattle, West Airbus, California Eastern Airways, Crystal Airways, Coastal Cargo, Convair Air Lines and General Airways.

Also featured for supplemental authorizations were Johnson Travel Service, Los Angeles Air Service, Mexico Air Transport, Miami Airline, Madison Air Transport, Overseas National Airways, Quaker City Airways, Regina Cargo Airlines, Seaworld Air Transport, Southern Air Transport, S. S. W. Inc., Standard Airways, Stewart Air Service, Tropic Caribbean Airways, Transocean Air Lines, U. S. Aircoach, U. S. Overseas Airlines and World Airways.

# 20 new 420 mph turbo-prop VICKERS VANGUARDS...



## Ordered by Trans-Canada Air Lines

**PURCHASE OF 20 NEW TURBO-PROP VICKERS VANGUARDS**—with an option on four more—has just been announced by Mr. Gordon McGregor, President of Trans-Canada Air Lines. Delivery will commence in the Fall of 1965. Explaining his company's action, Mr. McGregor said, "T.C.A.'s decision to order the Vanguard came after the most exhaustive equipment analysis ever undertaken by the company. The evaluation was made over a period of two years during which no other competing aircraft were thoroughly examined."

Noting the outstanding passenger popularity of T.C.A.'s fleet of Vickers Viscounts, Mr. McGregor added, "The Vanguard will have the same freedom from noise and vibration as the Viscount; it will

not present any runway length or strength problems. We expect to be able to operate it at remarkably low aircraft noise and seat costs. And we are convinced it will provide the ultimate in passenger speed and comfort."

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## SHORTLINES

► **Chicago Helicopter Airways** and **Ten** **Leh Airlines** have been admitted to the International Air Transport Association (IATA) with a total of 70 active and six associate members. Chicago Helicopter Airways, which started scheduled passenger operations last year, has become an associate member. Ten Leh Airlines, the parent of Tullahoma State Airlines, joined IATA as an active member.

► **Airlines Closing Doors** handled airline transactions worth \$18,000,000 in November, an increase of 19.4% over business transacted the previous November.

► **CINTRA Chilean Airlines** has introduced a fourth tier plan on its twice-weekly flights between Miami and Santiago.

► **Miami International Airport** had an operating profit of almost \$2 million in 1959. Gross revenues for the year were \$1,047,650, expenses \$1,035,510. Airlines are planning to spend about \$20 million for new facilities at the Miami Airport.

► **The American World Airways** will begin daily service between New York and the Dominican Republic, Haiti and Jamaica on Feb. 1. The new DC-8B service replaces the current schedule of three flights a week to the Dominican Republic and Haiti, and extends the service to Montego Bay, providing a direct connection between New York and Jamaica.

► **Trans-Canada Air Lines** will equip its Viscount fleet with Collins Radio Co. automatic pilot systems. Installation of the equipment is scheduled to begin in April.

► **Trans World Airlines** reports its domestic passenger traffic in the first week of 1960, passed 27% over the same period of last year. International traffic rose 18% for the same week.

► **United Air Lines** flew 324,405,000 passenger-miles in December, a 10% increase over the previous December. Air traffic volume increased 75% in the same period.

► **Air France** carried 24% more passengers during 1959 than in 1957 for a total of more than 1,200,000. Average aircraft load factor was 71%. Passenger miles flown rose 20%, and was up 11%, flight was up 15% over the previous year.

## AIRLINE OBSERVER

► **Trans-Australia Airlines** and **Tamworth Empire Airways** probably will place orders for Vickers Vanguard turboprop transports sometime this year. Trans-Australia, a state-owned airline, will receive government support for the purchase of two Vanguards but TIAL—which wants four Vanguards—faces financing problems and was hurt by the Britanica because of its attractive price offer from Bristol.

► **Southwest Airlines** will soon begin construction of a \$15 million headquarters and maintenance building at Wolf Chamberlain Airport in Minneapolis. New building will house 1,000 employees and be able to handle 15 four-engine aircraft for maintenance at one time.

► **Quincy Empire Airways** plans to dispose of its Super Constellations and three DC-4s in late 1959 or early 1959 in hopes of beating the flood of jetliners which is expected to hit the aircraft market once jet transport begins to come off the production line.

► **Pacific Northern Airlines** has flown 25 million passenger-miles since it was established without a passenger or crew fatality. The airline will complete 25 years of Alaskan service in April.

► **Air India International** has chosen San Francisco over Los Angeles as the terminus for a new turboprop passenger service, which is expected to start late next June or early July. Former economic manager for India, San Francisco Controller Terence J. Hendel, will be airline's district sales manager.

► **Airlines** will meet in Washington on Jan. 26 to review industry/electronics association studies as a result of contract cancellations by Collins Radio Co. (AW Jan. 14, p. 26). If present progress, which calls for a non-competitive electronic system is dropped, airlines can be forced to join a legal program involving a civil/military common system using cooperative equipment in aircraft.

► **Northeast Airlines** flight crews will fly as observers/passengers on British Overseas Airways Corp. Britannia between London and South Africa in the opening phase of Northeast's training program. The airline plans to visit British Airways in England to train its licensed personnel before beginning its own training program.

► **Fleet orders** for commercial aircraft rose from 329 in December 1955, to 444 in November 1959. Turboprops account for 25% aircraft in the current backlog.

► **Scheduled airlines** recorded a slightly improved safety record during 1959 over 1958 despite the United TWA collision as at Grand Canyon on June 30. Passenger fatality rate per 100 million passenger-miles for the entire industry was .53 in 1959 against .63 in 1958. The domestic rate was .64 in 1959 as compared with .79 the previous year. International and total annual airline fatality rate was .09 last year and .04 in 1955.

► **Air Transport Assn.** has raised objections to a recent proposal that Heston Airlines be provided her "space available" transportation for the scheduled airlines. ATA sees the frequent off- and on-loadings at intermediate stops would cause a disorganized type of service that would be detrimental to the refugee program. The association and other similar requests have been denied in the past to prevent opening the "backlog" to business requests on the same basis. Sen. Robert Thompson (D-Minn.) made the original proposal.

► **Air Line Pilots Assn.** will hold its annual Air Safety Forum at the Hotel Marlborough in Chicago March 13. The year's forum will concentrate on its "most currently critical air safety problems from an operational viewpoint," and aviation hubbub and hubbub transport and its safety control matters will dominate the meeting's agenda, according to ALPA President C. N. Sykes.

World Forest Journal Editors

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...with **TURBO  
COMPOUND-**  
powered Douglas DC-7Cs

A new link in the route to Europe is opened up by the new DC-12 "Global Express" of SAS—Scandinavian Airlines System—a service featuring the first and only nonstop flight from Los Angeles to Europe, with either one-stop routes that include New York (Lambert) and New York-Copenhagen non-stop, and through service to leading European cities. For all these flights, including those of its famed polar route from California to the Conquest, SAS chooses Douglas DC-12s powered by the Pratt & Whitney Turbo Compound 8 engine.

Today, 41 leading world airlines have selected the Turbo Compound to power the luxury flights, the blue-ribbon.com-to-entst.coment-to-entst.com and even across runs where speed and comfort are the keywords.

The fastest printers in server today are powered by the world-famous engine that combines speed, size, dependability and operational economy. With a backlog of more than 23 billion test miles, and with a perfect safety record, the Turbo Compound has proven its claim to leadership among the world's engine engines. The more than 33 million test miles now flow daily behind the Turbo Compound will increase to 100 million daily as fewer vehicles take effect.

### Airline Traffic—November 1956

	Revenue Passenger	Revenue Freight Weight Miles	Load Factor	U S Mail	Expense	Freight	Total Revenue Per-Mile	Net Cost Revenue Per Available Ton-Miles
<b>B-MILITIC</b>								
American	875,090	368,167	82 34	1,613,098	108,100	7,357,375	45,104,366	56.35
Boeing	108,472	45,280	83 33	228,119	128,312	228,517	4,688,518	66.45
Continental	341,203	141,638	82 34	261,351	191,148	1,198,518	11,898,518	68.27
Eastern	94,112	37,009	80 73	74,742	21,857	180,706	3,924,440	69.86
PA	166,205	67,234	86 30	320,798	207,978	977,425	10,841,497	55.35
United	852,132	352,127	82 34	1,614,757	469,418	2,644,757	26,444,757	67.99
National	180,476	64,840	86 34	344,113	67,520	400,657	7,093,365	71.35
Northwest	43,219	17,118	81 30	1,548	1,548	887,457	37,457	57.98
Northwest	100,467	40,006	86 30	253,242	223,477	723,321	11,823,321	68.45
Trans World	344,120	138,747	87 30	1,667,700	860,438	1,957,718	19,577,718	69.86
Western	495,208	195,103	81 33	1,991,079	1,410,456	37,754,456	37,754,456	69.86
Whelan	91,761	36,281	87 30	1,867,700	86,420	172,741	17,274,741	72.37
<b>INTERNATIONAL</b>								
American	10,248	7,322	33 40	11,204	320	308,106	1,283,426	81.78
Boeing	3,470	8,762	37 83	32,110	72,461	396,429	52,161	83.83
Continental Atlantic	14,327	5,137	1,108	1,108	3,340	91,346	91,346	81.78
PA	4,719	5,081	29 80	6,707	70,345	381,298	47,345	87.40
Eastern	18,221	26,482	24 74	1,821	1,821	1,821,217	1,821,217	89.41
United	4,772	5,136	34 80	8,457	32,814	88,348	88,348	81.78
Whelan	7,704	15,395	47 80	1,863,192	21,420	826,116	1,674,340	86.30
<b>Trans Atlantic</b>								
American	4,440	6,432	37 78	38,476	278,473	688,338	68,338	89.35
Boeing	61,261	9,407	48 18	1,167,413	1,461,314	1,461,314	1,461,314	89.35
Continental Atlantic	14,327	5,137	1,108	1,108	3,340	91,346	91,346	81.78
PA	4,719	5,081	29 80	6,707	70,345	381,298	47,345	87.40
Eastern	18,221	26,482	24 74	1,821	1,821	1,821,217	1,821,217	89.41
United	4,772	5,136	34 80	8,457	32,814	88,348	88,348	81.78
Whelan	7,704	15,395	47 80	1,863,192	21,420	826,116	1,674,340	86.30
<b>Trans Pacific</b>								
American	61,261	9,407	48 18	1,167,413	1,461,314	1,461,314	1,461,314	89.35
Continental Atlantic	14,327	5,137	1,108	1,108	3,340	91,346	91,346	81.78
PA	4,719	5,081	29 80	6,707	70,345	381,298	47,345	87.40
Eastern	18,221	26,482	24 74	1,821	1,821	1,821,217	1,821,217	89.41
United	4,772	5,136	34 80	8,457	32,814	88,348	88,348	81.78
Whelan	7,704	15,395	47 80	1,863,192	21,420	826,116	1,674,340	86.30
<b>LOCAL SERVICE</b>								
Alliplace	33,794	2,344	42 83	7,734	17,734	7,737	380,427	88.40
Boeing	18,424	2,421	48 83	3,720	3,720	3,720	380,427	88.40
Continental	1,683	1,683	3,720	3,720	3,720	3,720	380,427	88.40
Eastern	15,130	4,104	47 80	18,132	17,734	21,428	479,444	74.32
PA	15,130	1,844	47 80	18,132	17,734	381,298	47,345	87.40
National	42,502	16,253	84 30	84,300	84,300	1,461,314	1,461,314	89.35
North Coast	46,401	5,444	49 35	18,351	18,351	18,351	460,886	46.18
Rock	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
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Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
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Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
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Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806	6,214	29 20	10,318	10,318	10,318	429,423	46.18
Midwest	13,806							

\*Not Available

Computed by AVM/NOI with some slight repairs to the Civil Aeronautics Board



*First in Constant Speed Drives ...*



McDONNELL F3H



DOUGLAS RB-66



NORTHROP SHRIKE

BOEING 707



MARTIN P5M

CONVAIR F-102A



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DOUGLAS DC-8



NORTH AMERICAN  
F-100D



BOEING B-47C



MARTIN P5M



McDONNELL F-101

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SUNDSTRAND DRIVES  
have logged  
millions of flight hours  
setting records for  
reliability and performance**

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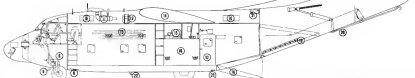
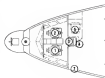
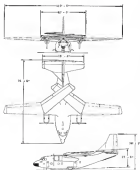
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**CONSTANT SPEED DRIVES • AIRCRAFT ACCESSORIES**

INBOARD PROFILE

- |  |                                   |
|--|-----------------------------------|
| 1 PILOT'S SEAT                                 | 12 OXYGEN                         |
| 2 CO-PILOT'S SEAT                              | 13 LITTER POLE STORAGE            |
| 3 CREW CHIEF'S SEAT                            | 14 WING STRUCTURE                 |
| 4 OVERHEAD ESCAPE HATCH                        | 15 A. F. U.                       |
| 5 NAVIGATOR'S SEAT                             | 16 MAIN GEAR WHEEL WELL           |
| 6 INFLIGHT ESCAPE HATCH (ON FLOOR) IN SIZE     | 17 REAR ENTRANCE DOOR (NOTR SEEN) |
| 7 FORWARD ENTRANCE DOOR                        | 18 CARGO RAMP                     |
| 8 MAIN GEAR - KNUCKLE FIELD, SLIDER SUSPENSION | 19 CARGO DOOR                     |
| 9 BARRIER - CRASH PROVISIONS                   | 20 ASSEMBLING HOOD INSTALLATION   |
| 10 LIFE RAFT STORAGE                           | 21 AFT DETACHED HATCH             |
| 11 SEATER                                      | 22 CATAPIULT SEEDS                |
|  | 23 HOLDSPACE FITTING              |



MODIFICATIONS of C-123 for dayboard use include folding wings to set width from 210 to 42 ft., fus from 34 ft. to height of 27 ft.

INTERIOR layout shows full back mechanism, overhead house each gear, catapult bolts. Top view of cockpit is shown.

## Navy Considers C-123 for Aerial Resupply

By Claude Witte

Washington—U. S. Navy is considering a proposal of Fairchild Aircraft Division to adapt the C-123 assault transport for aerial resupply of carrier task groups at sea.

Fairchild has suggested extensive modification of the USAF twin-engine aircraft to provide it with folding wings, folding tail, rotating hook, catapult hook and jet thrust augmentation. The

threat would come from Fairchild 144 dashjet units installed in each nacelle along with the regular Pratt & Whitney R-2600 reciprocating engines.

Thus equipped, the Fairchild study shows that the C-123 would be capable of operating from the deck of Essex class carriers. Carrying approximately 65,000 lb., the aircraft would be able to land, ascend and refuel in about 10 minutes. The Essex class carrier will hold 12 C-123s at a base, a figure that

will be increased for service on Midway or Hancock class carriers. The control deck is essential.

### No New Facilities

Assuming that the C-123 can easily operate over a radius of 1,500 mi., the report demonstrates that it could serve supplies in a task force area in the Northern Hemisphere from 16 existing U. S. land bases (see map on page 57). It follows that the aerial

## of Carriers

resupply concept could be used in this area without any important investments in land or water or support facilities.

The Fairchild aerial resupply concept naturally is based upon the proved assumption that the task force will be able to maintain air superiority despite the fact that it might be within striking range of enemy land-based aircraft. In this connection it is most significant that the true element in envisaged by Fairchild engineers will pro-

vide 12 to more C-123s to land without need while the carrier's combat planes are on the air as a strike or fleet protective weapon. As pointed out in theory, only one of the last carriers in a task force would be devoted for the resupply of carrier. This would leave the other three carriers with men to take aboard and lighter pilot effort for emergency deck space.

### Advantages of Plan

The Fairchild report, presented to the Pentagon last week, claims three various other advantages for aerial resupply.

• Regular and frequent replenishment of perishables, most important to the success of the mission.

• Frequent resupply of urgent items in case of emergency.

• Sharp reduction in requirement for a large inventory of reserve supplies aboard ship.

• Speedy recovery, inside combat zone if necessary, from losses in combat due to reinforcement required for warfare resupply.

Aerial resupply will not interfere with combat operations.

• Reduction of the task force's vulnerability to enemy attack during warfare resupply exercises. This applies particu-



ELEVEN C-123s, wings folded, are parked on forward deck in another carrier should during landing operations



AFTER unfolding, C-123s are reported. First plane is resupplied in the others, wings unfolded and engines started, await their turn.



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of gas turbines  
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ROLLS-ROYCE LIMITED, DERBY, ENGLAND.



C-124s operating from three different existing bases could supply tank forces anywhere in the shaded areas. The base at Kaseki in China is shown twice—at the extreme left and at the extreme right.

tury to the choice target characteristics of a surface supply operation if it is under fire from enemy aircraft or sub-marines.

• **Reduction in requirement for rear base and logistic support personnel** required to handle surface ships at sea, eliminating specialists for surface supply activities.

#### Floating Warehouse Fleet

At the initial stage, the Fairchild proposal would have the C-123s supply the tank force directly, landing them one at a time in order to maintain combat capability during the operation.

A later perfection of the plan would add a fifth element to the fleet, a CVS or floating warehouse. From this ship—

where all supplies would be collected from the supply goods could be distributed to destroyers, cruisers, carriers, command ships and submarines by helicopter.

The helicopters would be equipped with such cargo as external tanks. Supplies could be prepackaged and loaded on pallets. The pallets, equipped with roller wheels, could be pushed in and out of the aircraft with ease and crews could for storage aboard the CVS as the element to another ship in the fleet.

At the outset, Fairchild engineers say, all supplies except POL (petroleum, oil, lubricants) could be fed to the tank force by converted C-124s. In a new era of atomic powered fleets, they maintain, even this requirement will disap-

pear and a complete airborne supply operation will be possible. Furthermore, as atomic powered vessels will be able to carry enough supplies fuel for an extended voyage.

The carriers will have to carry gasoline and equipment to refuel the C-124s, but this is not expected to add substantially to the surface-borne fuel supply problem. Present tankers provide sufficient storage to take care of the additional gasoline needed.

#### Loading Gear Redesign

Modification of the present USAF C-123s must include redesign of the loading gear to take the tough punch met by enemy landings. Additional equipment must also must be included for emergency flight. A seat for the navigator will be added in addition to one for the crew chief.

More than a year ago, Fairchild represented with a C-123 that had a 144-horsepower engine cranked as much weight to supply 1,000 lb thrust. As a result of the augmentation, test were good and showed that the rate of climb could be increased from 150 to 500 feet a minute.

On the other hand, the C-123s, it will be necessary to dispense with engines on the wings and fuel pylons because of the folding wing. For this reason, the 144s will go into the regular engine nacelle.

The 144 in this position will require less corrective action by the pilot if he is forced to use it in event of a misoperating engine failure. Wing-stall capabilities will be good, Fairchild says, and the plane will be able to make a second



CONVENTIONAL supply fleet referring to as a substitute to stock.

## CAPABILITIES . . . Manpower, Tools and Experience



BEECH BUILDS	
	MA-2 MULTI-PURPOSE VEHICLE
	C-12, MD-2 POWER UNITS
	5-PLACE BEECHCRAFT SUPER 18
	6-PLACE BEECHCRAFT TWIN-JOHNAN
	4-PLACE BEECHCRAFT BONANZA
	BEECHCRAFT T-38 TEASSEL
	BEECHCRAFT L-23 TRANSPORTS
	TWIN-ENGINE-MAJOR SUBSISTENCE SUBCONTRACT PRODUCTION

Producing canopies and windshields for CONVAIR'S USAF F-102 jet fighter is a proud undertaking for Beechcraft. We're busily engaged, too, in classified engineering design studies of other F-102A and F-106A aircraft components.

For more than 24 years Beech Aircraft Corporation has served the aviation industry, earning an enviable reputation for quality products and on-schedule deliveries. Beechcraft's five major plants with 1 1/2-million square feet of plant area and more than 6,000 skilled employees are at work on a wide variety of prime and subcontract orders . . . including special projects for BOEING, McDONNELL, REPUBLIC, LOCKHEED and other leading aircraft manufacturers who depend on Beechcraft's capabilities.

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# Beechcraft

BEECH AIRCRAFT CORPORATION, WICHITA, KANSAS, U. S. A.

## Thor Test, Assembly Facility Is Planned

Test and assembly facilities for the Douglas Thor intermediate range ballistic missile are being planned on a 1,700-acre site adjoining the Avondale General rocket test grounds near Phoenix, Calif. in the Sacramento area. Over \$4 million will be spent on the site in 1957.

USAF awarded the company a contract for \$1,305,500 to build guided missile program support facilities. F. W. Conant, senior vice president, said

the company would spend as much as \$3 million of its own money on the project.

The money will be spent on land clearance and construction of roads, waste test stands, assembly and mock-up facilities, hangars, a cafeteria, a fire and plant protection building and a control building.

Contracts totaling more than \$2 million have already been awarded to A. Truchess and Sons, Sacramento, build-out; Construction Co., Marysville; George A. Fisher Co., Los Angeles; Consolidated Western Steel Co. and the American Bridge Co.



HELICOPTER using cargo net, hoist, carrier.



HELICOPTER using sling, supplies, antenna.

approach with ease, even with one engine not operating.

Provision of the folding wings and tail, to permit the C-123 to be lowered on an aircraft carrier deck, is considered necessary only for cases of route emergency.

A C-123 in need of maintenance, with an engine out on a flat top, would contribute the deck.

This feature also will facilitate ferrying of aerial resupply planes to carrier to distant land bases.

### 'No Cost' Study

Frankford's proposal is a "no cost" study, prepared with Navy approval but without a contract. The company has suggested that the Navy contract for an evaluation of the idea with a current C-123 equipped with the additional J44 engines.

It has argued that the proposal would give the Navy a new aircraft at minimum cost, promising increased strike potential for a task force along with economy in shops, personnel, inventory and fleet vulnerability.

On top of this, the Marine Corps is known to be interested in the C-123 for assault transport missions. In this activity, it would supplement transport helicopters in Marine vertical development tactics.

The Frankford company is expected to make another proposal incorporating these ideas.

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Control and finesse of Whittaker gyro systems combined activity of float produce dual. This device is used in one of the most critical design projects as that (control) systems as precision watch . . . control system . . . and the entire rigidity of the assembly would be achieved.

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VAN NUYS, CALIFORNIA  
WHITTAKER T-3000

Another reason why G.E.'s newest turbojet

makes possible the ideal medium-range jetliner

## General Electric CJ-805 Offers Best S.F.C. for Medium-range Jet Operation

The three most important things affecting fuel consumption in a jet engine are compressor pressure ratio, component efficiency and turbine operating temperature. Because all three are optimized in General Electric's new CJ-805, commercial counterpart of the J79, you are assured of the best possible S.F.C. over a wide range of flight conditions.

**1. High pressure ratio**—Using a simple, lightweight and straightforward component design, the 10,000 lb./thrust class CJ-805 offers the ideal pressure ratio for efficient cruising operation.

**2. High component efficiency**—CJ-805 components were developed by experienced designers, proved in the superior J79. They provide tolerance to the requirements of airline operation without sacrificing high efficiency. For example, the engine's combustion and control systems are designed for top efficiency with JP-4, JP-5—or aviation kerosene.

**3. Optimum engine operating temperature**—As rated for airline operation, the CJ-805 has a turbine inlet temperature below that of the J79. This maximizes component life, yet offers high thrust at lowest engine weight.

For further details on the CJ-805, contact your G.E. Aircraft Engine Specialist. You can reach him via your nearest G.E. Aviation & Defense Industries Sales Office. General Electric Company, Cincinnati 26, Ohio.

**MOST ADVANCED COMMERCIAL JET ENGINE IN THE WORLD.** General Electric CJ-805 will enter subsidized service in 1969. First option from will be Delta Comair Model 880's ordered by TWA and Delta Air Lines.



**CONTINUOUS G-E RESEARCH**—for example, studies on "hot-end" alloys—have paid off on new CJ-805. To develop and produce new engines, G.E. has invested in facilities with replacement value of \$106,808,804.



**MORE FACTS ON GENERAL ELECTRIC CJ-805** and the benefits it offers medium-range jets are contained in this 8-pg. short, available to qualified airlines. Contact G.E. Aircraft Engine Specialist for savings presentation.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

# STAFF COMPUTER ENGINEERS

Today all engineering including advancement rate of engineering, per se, is one of the most sensitive of the company's most important, necessarily restricted to the effect of a change in pay substantially the same degree on another person. Moving to a new position after various successful assignments but the same opportunity for long range growth may be restricted by the same factors which have limited advancement on the individual's former job. We believe that we can offer an opportunity for an engineering opportunity equivalent to what fairly their previous experience in an area where either broader responsibilities with corresponding increase in salary.

The adaptation of established using computational techniques to the design of a permanent modern-built system for the maintenance of a particular aircraft is the fundamental responsibility of our Engineering Division.

Staff Aviation Computer Engineers (particularly those with unexcelled experience) are carefully qualified to accept more responsibilities in this area. The computer engineer who fills this position will direct his efforts to keep the firm of product development and design on a satisfactory dollar project, such as effort often requires the advancement to higher management levels which are, we believe, desired more engineers working in a computer staff group. It should be recognized that by performing in this effort, an engineer is actually directed to the direct support of our present and future aircraft design staff, adding as an indirect supporting capacity with extensive knowledge of overall responsibility. Lack of electronic design experience or the absence of a professional understanding of specialized electronic theory at a professional level should not be a disqualification for this position, as the engineer will be well-served by an established team of electronic experts in our Research and Development Department.

It is noted that the applicant be capable of possessing large-scale 4-c. using systems for 3-dimensional and time computation of flight dynamics. The applicant should also have full knowledge of the design of analog computer elements and the effects of these factors on overall system stability and accuracy. The successful applicant will provide a high level of responsibility and, in addition, in conjunction to his previous job, previous experience upon successful completion of his duties of first-order

more variables, reinforcement of existing under utilization during conditions, and professional maintenance of standard equipment to achieve improvement in accuracy or simplification of existing and hardware using a direct approach. Since the final result of his efforts will be embodied permanently in specialized equipment manufacturing in quantity, machine must be placed in an organization of equipment design to an extent not necessarily considered necessary in the laboratory computer staff which functions in the operation of a computer laboratory staff group.

The responsibility for development of complex computer systems for production represents an additional challenge which attracts the professional engineer of the position into which increased opportunity for growth.

Link Aviation, Inc. is located in Birmingham, New York, in an area of growing electronic and precision manufacturing activity. Several modern factors have been retained in the manufacture of electronic equipment have moved to this area because of ideal living conditions, high standards of municipal and state government existing schools and absence of racial and religious problems. The Birmingham area is increasingly becoming a center of employment opportunities, a policy which has resulted in the absence of labor strife for over a decade.

The area is centrally positioned for pleasant leisure activities. The area proximity of many lakes is valuable to boating enthusiasts and fishermen. The New York, State Park System offers many well-developed recreational areas of natural beauty. Hunting and boating areas are within easy driving distance.

Link Aviation offers many advanced fringe benefits including a comprehensive medical plan for you and your family as a fixed benefit of service, an attractive profit sharing retirement plan and dental insurance coverage. In addition, we are prepared to offer to any employee an unusually attractive plan for reimbursement of moving expenses which reduce an advance initial expense not generally recognized by industry labor. As a subsidiary of the General Precision Equipment Corporation, we can offer the many advantages of working with a multinational company. (This employee) together with that group, financial stability and technological interchange advantages of a large corporation.

John Best  
Manager, Engineering Division  
Link Aviation, Inc.  
Birmingham, New York  
Telephone DA-8111

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**LINK AVIATION, INC.**  
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION  
BIRMINGHAM, NEW YORK



## Volunteers Breathe Ozone Mix for Test

A recent and brief volunteer service from the Air Force School of Aeronautics have subjected themselves to controlled concentrations of freshly ozone to learn how big a dose the human pilot can survive.

Ozone is a most powerful oxidant than its active, poisonous oxygen, and is present in initial quantities in the atmosphere now being approached by high performance aircraft.

Dr. Hans Georg Claassen, involved an intense concentration of eight parts per million for one hour in a chamber of the Ames Research Institute of Moffett Field, California. "My lungs began to fill with fluid and my breathing capacity was cut down to about 70%," Claassen reported to his fellow scientists. Results indicate that in sensitive persons, concentrations as low as five ppm may cause severe lung irritation in less than an hour. Mix prepared by the Ames Research Institute from laboratory animals. The study was



## Armrest Control

Control stick is replaced in a T-38 jet cockpit test installation by complete flight control in which ailerons and elevators are operated by moving armrests. The machine only linked system compensates for a wide range of longitudinal and vertical adjustment. It was designed to maximize workload of the T-38 and present stick not used to be reduced without loss of some ability. Theoretic is controlled by flow and movement of both armrests and ailerons is controlled by differential movement. Hand and wrist are used for aileron control. The pilot's seat was completely redesigned to provide clearance for the forward motion of the armrest and for aileron and lateral armrest between seat and console. A linked system enables the pilot to sit in the seat not to provide the experimental results. Unit was designed by C. O. Neville & Associates, Inc., under USAF contract.

# Ex-Cell-O Precision at Production Prices



HYDRAULIC & PNEUMATIC ACTUATOR ASSEMBLIES

FUEL CONTROL AND METERING ASSEMBLIES



FUEL NOZZLES FOR JET ENGINES

JET ENGINE BLADES



MISCELLANEOUS AIRCRAFT AND COMMERCIAL PRECISION PARTS

JET COMPRESSOR ROTORS

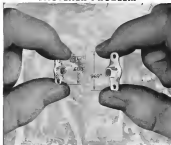
Ex-Cell-O's facilities include laboratory control of materials, design and process engineering, machining of all materials, complete quality control to meet the most exact specifications, and delivery to meet customers' requirements.

For information or a quotation, write or phone the Precision Products Division of Ex-Cell-O.

**EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN**

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • MILLING PINS AND REEDS • DRILLING DRILLS • GRINDERS AND MORE LABOR-INTENSIVE PARTS • QUALITY ASSURANCE

## FASTENER PROBLEM



New LHTA-18 nut on left, standard another one on right

## "SPACE-SAVER" anchor nuts needed for avionic applications

Shrinking space allowances and the urgency of eliminating every possible pound of weight, are problems that continuously confront electronic and engine design engineers. The "black boxes" for radio, radar and missile guidance systems at a radar control station for construction and maintenance are affected. One of the most urgent needs was for a tiny "Band" anchor nut for attachment of sensor components. Lowest possible weight and size were required, the ability to withstand temperatures in the area of 500° F. was desirable.

Type LHTA-18 is ESN's answer. Over all length of .688" compares to .688" for a standard 10-32 size AN-306 locknut. Weight is only .17 lbs per 100 pieces compared to .35 lbs. These space saving, Band® nuts meet the same torque and vibration requirements as the standard used nut and will withstand temperatures up to 500° F. Like all self locking Elastric Stop® nuts they are dependably self locking, and are guaranteed for extended re-use. Sizes 4-10 thru 1-28 sized, anodized plated. Space savers are also available in one-lug and cone-nut-mounting anchor nut shapes.

### MAIL COUPON FOR DESIGN INFORMATION

Elasto Stop Nut Corporation of America, Dept. EN-22  
3230 Vantage Road, Union, New Jersey

Please send me the following free bulletins as indicated:

☐ Bulletin on Elastric Anchor Nut

☐ Here is a drawing of our product  
Which self locking fastener would  
you suggest?

Name \_\_\_\_\_ Title \_\_\_\_\_

Firm \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

a continuation of our conducted on cases.

Chenoweth reported, "The impact of cancer on men, as on animals, is illustrated on the left tibiae of the representative test. Beginning at the distal, longer exposure times and higher ionization loads tend to carry the injury to the tissue deeper in the legs."

Setting of the leg bones seems to begin at concentrations of 4 or 5 rpm at exposure times of about an hour. The lower level for workers subjected to cancer produced by industrial operations has been set at 0.1 rpm.

Among other effects reported by Chenoweth was an improvement in the sense of smell. For the sense of smell test, three solutions were prepared. One was a blank, one produced a pleasant smell and one produced an unpleasant smell. As the test progressed, the subjects lost the ability to identify the solutions. This effect might be turned to good use as an indicator of dangerous concentrations.

"Symptoms such as hoarseness in the throat, feeling of oppression of the chest, and difficulty in breathing were subject to a large individual variety," Chenoweth said. No healing of the eyes was observed and no effect could be found on blood pressure, pulse rate, or blood chemistry.

## Japan Sells Radar Detector to India

Tokyo-Japan will sell a radar search detector to India for installation at the International Airport in Coimbatore. Called the NMD-413, the radar set has proved to be highly effective in tests at the Metropolitan Research Institute in Tokyo and Osaka.

The model costs several times more than the English one used in India up to now, one feature consists of range-height finders which enable it to measure the altitude of dual force jets.

It has a maximum power output of 200 kilowatts and a wave range that covers a radius of 100 kilometers. The radar is the Japan Wireless Company.

## GE Missile Unit Laboratory Formed

An Autonomous Laboratory has been formed within the structure of General Electric's Missile and Ordnance Systems Department to conduct or direct applied research in specific fields of technology.

Manager of the laboratory is Dr. Lee Stog, formerly manager of advanced rocket systems engineering for GE. Stog also taught graduate courses at Cornell University and was a consultant to



## ON CALL...around the clock...around the world

There are approximately 2000 Canadian-built aircraft in civilian and military service around the world. Whenever they fly, their operators know that Canada's personal service on operational or maintenance problems is quickly available.

Canadian technical representatives, at present based on five continents, are always on call. These men have been selected because of their extensive knowledge of maintenance problems and their specialized experience on the equipment in their charge.

Their work is supplemented by aircraft systems trainers at the operators' own bases; service repair and overhaul groups at the main Canadian plant, and manuals, handbooks and operational bulletins to all customers. To Canadair, service is a continuing obligation—around the clock and around the world.

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For solid rocket  
motors with a  
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system and  
control in Chief  
Engineer  
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Andrew Cole

## Hallamore's doing it now

Hallamore Electronics Company is currently producing 13 segments of the electronics field essential to the success of our national defense program... 1 Missile and aircraft test and ground support equipment (development through installation); 2 Missile instrumentation and guidance systems; 3 Communications systems (aerial and visual); 4 Magnetic amplifier products (integrated power supplies etc.); 5 Electronic components. The Hallamore team, approximately 150 engineering personnel, passed the 750 figure in October of 1956 at its last expanding new Anaheim, California facility—a dynamic, do it now organization.

HALLAMORE



ELECTRONICS COMPANY

a division of the NUCLEAR CORPORATION



Project Launch at MIT and to the Reno-Woodbridge Corp.

The laboratory expects to complete its test facilities in 1957 including what the company described as the world's most modern shock tunnel chamber, a solid furnace and other equipment.

Maneuver of the laboratory is to extend the knowledge of hypersonic, supersonic, semi-hypersonic and other fields into extensive technological areas.

## Hoff Appointed Head Of Stanford School

Palo Alto, Calif.—Nobels J. Hoff, head of the aeronautical engineering department at Polytechnic Institute of Brooklyn, has been appointed to the head of Stanford University. He will be a professor and executive head of the university's newly autonomous Division of Aeronautical Engineering.

The study formerly was included in the Department of Mechanical Engineering. Hoff, a leading researcher in aerodynamic structures, served as chief of aerodynamic structures at the Naval Ordnance Research Institute before World War II. He holds a Ph.D. degree from Stanford.

## Talco Buys Stock Of Falcon Aviation

Hamden, Conn.—Talco Engineering Co. of Hamden, Conn., has purchased stock of Falcon Aviation Corp. and taken over lease of a house, warehouse and other buildings at Falcon Field from the city of Mesa, Ariz.

F. G. Talco, Talco president, said the firm will use the facilities for testing jet engine parts for airplanes. The company manufactures the parts for the Air Force through the General Dynamics of General Dynamics Corp.

## AiResearch Builds New Phoenix Facility

Phoenix, Ariz.—AiResearch Manufacturing Co., Arizona Division of the Garrett Corp., will expand at Phoenix to include an added 40,000 sq. ft. building to house 400 workers at a cost of \$400,000.

The unit will be designed by the AiResearch test facilities and manufacturing plant already in operation. The new unit will accommodate the firm's growing sub and electronic business.

Maxwell Galloway, manager of the Arizona Division for Garrett, said as a result of this additional space, our turbo-machinery departments will be able to expand within existing areas factoring area.

AVIATION WEEK, January 21, 1957

## Farnsworth HAS THE ANSWER



... before the button is pushed

Four... three... two... one... five! A test finger pushes a button.

Winners... and a fiery missile successfully heads for its target. It works!

Of course, it had to work. In atomic warfare there's no second chance.

Farnsworth, a division of International Telephone and Telegraph Corporation, developed the vacuum electronic test equipment that knows—before the button is pushed. This not only avoids costly misfires or missed targets—it actually safeguards our very lives.

This is another answer supplied by Farnsworth Electronics Company, where scientists and engineers of many varied skills are applying the vast experience and facilities of IT&T to solve many complex problems in the fields of electronics and communications for industry and the military.



Farnsworth

CAREER OPPORTUNITIES: There are important new openings in our professional staff for production engineers and executives. Write for complete information, confidential.

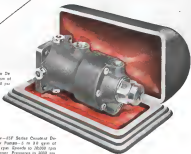


FARNSWORTH ELECTRONICS COMPANY, Fort Wayne 3, Indiana  
A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

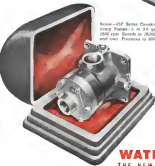
# STRATOPOWER® HYDRAULIC PUMPS

SERIES  
65F and 65W

Eight-155P Series Variable De-  
livery Pump—31 to 10 gpm at  
1000 rpm. Pressure to 3000 psi



Seven-45P Series Constant De-  
livery Pump—5 to 38 gpm at  
1800 rpm. Speeds to 16000 rpm  
and over. Pressure to 3000 psi



From the first concept, through the prototype and on into production, **STRATOPOWER** Hydraulic Pumps belong in the forefront in the development of guided missiles and jet aircraft. The higher the accent on reliability, the more important becomes the jewel-like precision, greater compactness and light weight of Series 65F and 65W Pumps to soundly meet your requirements. Get all the facts on new developments in high speed, high capacity **STRATOPOWER** Pumps... write today to Dept. 732A.

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**NOSE SECTION** (left) and mid fuselage and wing section (right) were hoisted separately at Plant 1 at San Diego, Calif.



## Convair Assembles Wood 880 Mockup

Wooden mockup of Convair's 580 four-engine jet transport was built in sections in one building (right), moved in sections (left) to a pressure building where it was assembled (below). The \$25,080 building for the mockup will house one complete airframe, and a fuselage mockup. Cockpit and interior arrangements for Twin Wood Airlines and Delta Airlines, best to order the transport, will be installed. The 180x280 ft. building will have air-conditioned, emergency egress lighting.



**HAILED BY THE AVIATION INDUSTRY FOR ITS OUTSTANDING  
STYLE • DURABILITY • COMFORT • PRACTICALITY**

**TRILOK**

*New York Helicopters with interior done by Goodyear Color-Dyne in Trilok*

As advanced as America's helicopters... this amazing new fabric not only meets—but surpasses—the rigid requirements for plane interiors. An exclusive development of United States Rubber, Trilok has been designed specifically for the aircraft industry to give peak styling with minimum weight (it's only 22 to 24 ounces per square yard). Trilok is woven with unusual deep-dimensional textures that add to comfort and safety features. Proven with a high degree of sound absorbency, Trilok is also exceptionally durable and selected for beyond requirements. Pioneering new Trilok is one of the great fabric in textile manufacturing exclusively by United States Rubber, Trilok Division, Rubber City, W. 42nd St., New York 36, N.Y. *Registered & copyrighted*



**United States Rubber**

## Convair Hires Five Research Scientists

Convair's Department of Scientific Research has added five scientists to its staff.

The specialties of the five add more the direction being taken in studies of the department, which is devoted to basic research in the fields associated with advanced aircraft and missile technology.

Dr. John E. Noggle was a research associate at the University of Minnesota. His work was with the chemical analysis group. Members of this group led to the discovery of the presence of heavy metals in primary engine oil and the mechanism of hydrogen-containing reaction. Recently they also led to improvements in photographic emulsion research techniques. He is

conducting upper atmosphere research at Convair.

Dr. Gila Myers is now conducting electron paramagnetic studies and research in thermodynamics and high temperature and lower chemistry. He was associated with the Stanford Research Institute where he did work on a five dimensional program to determine high temperature thermodynamic properties of a series of elements. He also has studied the kinetics of decomposition of rocket propellants, heat and mass transfer in liquid metals, various spreading, solvent extraction and kinetic studies using traces.

Dr. Harold A. Papayan will do research in the chemistry and physics of free radicals which will contribute to development in the field of rocket propulsion. He came to Convair from the Research Division of Raytheon Manufacturing Co. where he studied solid



**Torture Ring**

Engineers study the high-temperature effects of simultaneously heating and cooling a metal ring while subjecting it to stress at North American Aviation's Los Angeles Division. The hot side of the ring, which simulates a portion of an aircraft's turbine, is heated to about 1850° by the burning of pulverized kerosene fuel inside it, while the inside is cooled to 985° by cold air blown through perforated aluminum tubes. Meanwhile hydraulic pressure pulls at the metal to simulate stresses that might be encountered in flight. The costs of tubes and wires surrounding the scale carry power to the pumps, air for cooling, and electronic impulses that report data to recording devices.

## BUCKETS and BLADES for AGT

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**We machine to ✓**

- Bearings
- Solid Stock
- Investment Castings
- Centrifugal Compressor Wheels



**Therm-electric  
METERS CO., INC.**

**Ithaca, New York**



DC-8 serves as convenient refueling of fleet Multi American Super Sabres.

## Fuel Flow Measured 50 Times Faster With New General Electric In-Flight Refueling Transmitter

Developed to help speed air flight transfer of fuel from Air Force KC-88 and KC-135 flying tankers to bombers and fighters on language operations, the G.E. In-Flight Refueling Transmitter is capable of measuring up to 10,000 pounds of fuel per minute as compared with the 200 pounds per minute performance of earlier models. The new transmitter unit weighing only 37 pounds, is mounted in the fuel line leading

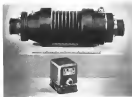
to the line or hose which extends from the tanker plane during refueling. The transmitter complements its light weight with rugged construction to withstand the shock of peak flow surges including engine flow—the surging back of fuel when the refueling line or hose is detached into the tanker. The flowmeter transmitter can operate at pressures up to 100 pounds per square inch,

measuring the fuel transferred with error of less than one per cent. Density compensation is not required, and the new flowmeter is insensitive to temperature and altitude changes.

For more information on this or any other aircraft fuel control instruments call your nearest General Electric Apparatus Sales Office.



Mounted in each of the three refueling lines on the tanker, the General Electric In-Flight refueling transmitter meters fuel in the refueling operation at pressures up to 100 pounds per square inch.



This lightweight G-E transmitter can measure up to 10,000 pounds of fuel per minute. Gas pressure supply provides a constant frequency current from 400 to 600 cycles per minute.



15 pound transformer-rectifier has expanded life of 5000 hours at temperatures to 71°C.



General Electric, unregulated transformer-rectifier will give the Douglas DC-8 28-volt dc power. Voltage fluctuation is limited to  $\pm 7.5$  percent without additional regulation.

## Lightweight, Unregulated Transformer-Rectifier for Douglas DC-8 Features Narrow Voltage Fluctuation

Four General Electric unregulated, automatic transformer-rectifiers, rated 35 amperes, 28 volts at full load, will furnish direct current power for the new Douglas commercial jet airliner. The significant feature of the completed units is the narrow voltage fluctuation and low volt-ampere peak ripple obtained without reactors or other heavy regulation components.

Within a load range of 0 to 25 amperes and 400-cycle input changes ranging from 150 to 250 volts line to line, the output voltage will remain within the limits of 25 to 29 volts. Maximum performance within these limits can be expected through 5000 hours of operation and at temperatures up to 71°C.

By using a transformer-rectifier, the new jet transport will have a reliable source of "on-the-spot" dc power without the weight penalty of additional generating equipment and long line runs. The G-E unregulated transformer-rectifier weighs less than ten pounds and contains no moving parts.

The unit consists of a three-phase transformer and Vaco-Weld® high temperature, corrosion-resistant, welded joints for mounting.

rectifier cells and contains a shunt for measuring output current. Each a conversion model and has an expected life of 5000 hours when operated at 35 amperes load, within the limits of 25 to 29 volts over any input or load condition up to 25 amperes the entire life is expected.

For further information on General Electric airborne, transformer-rectifiers, loads regulated and unregulated, contact your nearest G.E. Apparatus Sales Office or check "A" on coupon below.

## New 2PDT Subminiature Relay Gives Reliable Performance at 30 G Shock, Temperatures to 125°C



Small addition to General Electric's line of subminiature relays makes possible for aircraft and space applications.

Built to give increased reliability to electronic equipment subjected to severe environmental conditions, the new General Electric 2PDT Subminiature relay will stand 30 G's shock with no contact opening or other assigned or deranged position. The relay rated 2 amps in suitable for continuous operation at 125°C ambient temperature and is unaffected by vibration of 10 to 50 cps at 12 inches/sec, or 55 to 500 cps at 15 G's/sec, or more. The operating advantages of this relay are further complemented by small size, 60 mils in diameter by 1.25 inches in length for the standard unit. The relay weighs approximately one ounce and is available in a wide variety of end ratings.

Space resistance is increased by heat treating the beryllium copper contact springs. The relay design is the conventional plunger type with provisions made for "float" work of the General Electric Co.

adjusting the open gap position of the plunger after the relay is assembled in the unit. Operating time with normal voltage applied to the coil is approximately 10 mils seconds; drop-out time approximately 5 milliseconds.

For more information on the 2PDT relay and other types of General Electric subminiature relays, contact your nearest G.E. Apparatus Sales Office. Check block "B" below for your free copy of the new 2PDT subminiature relay brochure.

Mail to:  
 Service 6750-100  
 General Electric Company  
 1 River Road  
 Schenectady, N. Y.

☐ "A" Airborne Transformer-Rectifier  
 Bulletin 68A-6409  
☐ "B" New 2PDT Subminiature Relay  
 Bulletin 68A-6410  
☐ Other literature printed  
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*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**



ACTUAL SIZE

## LIGHTER, SMALLER ADF WITH GREATER ACCURACY, HIGHER SENSITIVITY

### NEW, COMPACT BENDIX DFA-70 HAS INCREASED EFFECTIVE RANGE, ELECTRICAL TUNING, FLUSH-MOUNTED ANTENNA

Bendix® ADF—long the "standard of the industry"—reaches another new high in performance and reliability with this new, improved DFA-70 system. Covering all frequencies from 30 to 1750 kilocycles, it provides both manual and aerial navigation information, including narrow-band Conical reception. And with the greater accuracy and higher sensitivity that have been built into the

system, a significant increase in operating range is obtained.

One of the important features of this new system is the increased tuning ability, permits the Control Panel to be located as far as 30 feet from the receiver. In the design of the DFA-70 Control Panel shown above, human engineering principles have been used to make tuning fast, easy and precise. Frequency knobs are labeled for quick identification, panel markings are large and easy to read; location of controls on the panel is planned for maximum accessibility.

Another important feature is the newly designed flush-mounted loop antenna. With this new unit, pre-tensioning stage is greatly reduced and drag is completely eliminated.

For complete information and specifications about the DFA-70, write Bendix Radio Division, Aviation Electronics Products, Robinson 4, Maryland. Or West Coast—10908 Magnolia Boulevard, North Hollywood, California; Export—Bendix International Division, 315 East 43rd Street, New York 17, New York.

MODEL 70-100



TO SEE DFA-70 RECEIVER features and details, visit Bendix, 315 E. 43rd St., New York 17, or nearest Bendix office for complete product literature.

Bendix Radio Division



vital physical-chemical properties. He also has recognized volatile properties in semi-conductors such as silicon and germanium.

Eugene J. Petric, staff scientist in mathematics, taught the subject at Milwaukee College St. Paul, Minn. He is a specialist in nonlinear differential equations which are used in semi-conductor machines. He now is studying the equation that governs operation of an ion limited device.

Robert J. Goad will do research in surface chemistry and adhesion. He worked on the subject at the University of Cincinnati.

The new appointments bring to 11 the number of scientists expelled of failure in the department.

### Particles Provide Stronger Magnets

New magnets made of elongated sub-microscopic particles of iron pressed together are as strong as the best Alnico type permanent magnets and can have 100,000 times the resistance to demagnetization that ordinary iron magnets have, according to the Invention Department of General Electric Co., Lynn, Mass.

Sub-microscopic iron whiskers are grown in electrolyzing iron salts in



German Dilatometer

Dilatometry is made in Wittenberg, Germany, by the E. Leitz Co. to determine coefficient of expansion of metals under heat. Used as aid in judging thermal stresses at Southwest Research Inst., machine is to measure the effects of thermal loads in operation on ground test motors. Data on stress was caused by particle blowing on test specimens by strong vacuum laboratory bellows. Combined picture of right is an electronic furnace capable of heating test specimens to 2,000°.

### Aircraft's Who's Who Experts

A cross section of the Who's Who in the aircraft industry—including Douglas Aircraft, Fairchild, Grumman, Martin, Republic, Canadian Ltd., Pratt and Whitney among a host of others—is reported to have reduced engine wiring time as much as 60%. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have seen service with the army, navy and airline since 1945. Improvements include the exclusive diagonal jaw design that permits easier access to hard-to-reach areas, and clamps a wire like grip on the rim by pulling it into a 30° bend thus delivering added leverage for twisting.

In addition to the greatly increased engine wiring speed, users attest to improved shop safety—fewer skinned knuckles and burned fingers.

Besides their production line assignments, Robinson Wire Twister readily adapts to the shop to bench work, on radio and motor equipment, on magnetos, alternators, instruments and sub-assembly work of all kinds.

Get price a \$19.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. W, Box 3194, 2030 Crosby Way, North Sacramento 15, California.

## A little pull in the right place...



... saves  
¾ the usual  
wiring costs

the ROBINSON  
Wire Twister

# announcing the achiever!

## AC's new inertial guidance system...



### AC HAS COME UP WITH A BUILT-IN "ONE- TRACK MIND" FOR GUIDED MISSILES

With one of the most significant advances yet made in the field of guidance, AC adds a vital new bonus to America's arsenal of defense. The **ACHIEVER**—a new type of inertial guidance system—brings together accuracy, ruggedness and dependability in an Air Force ballistic missile.

Heart of the system is a remarkable gyro stabilized platform of such precision that the slightest variation in velocity or in its velocity can instantly be sensed and precise corrections made.

This great new development is one phase of AC's work in a prime contract for the Air Force Ballistic Missile Program. It is one more example of AC's leadership in the field of state-of-the-art research and development.



THE ELECTRONICS DIVISION OF GENERAL MOTORS

FIVE, RIVERVIEW • NEWBURGH, NEW YORK

molten metal cathode and then plating the dust from the liquid metal by conventional magnetic action.

The whisker is also placed in a powerful magnetic field and suspended in a liquid metal pool pressure along with a binder. As this binder can be metal, plastic, glass, or rubber, the final product can have wide versatility. G. E. Thomson Page, leader of the research group which developed the magnetized whisker, says the stronger the magnet, the further apart, the greater the resistance to demagnetization.

For the future, GE predicts that this method will produce magnets of "undiminished" size.

Known for the strength of their magnets, it is that unlike conventional magnet pieces or rods, these fine particle magnets are not divided into domains of coexisting magnetic directions. Instead the fine particle magnets are composed of elongated particles, all lined up in the same direction. The particles have been made so small that they cannot support coexisting internal domains, Thomson said.

The magnet is not expected to be put on the market for a matter of years. However, GE is now manufacturing an use in miniature circuit components, in engine turbochargers, and for use in the vacuum line of nuclear reactors.

## British Optimistic on Vanadium Research

London—Series of lightweight vanadium metal alloys may become available to industry in a matter of months, now being carried out in Britain, also methods of producing such alloys on a commercial scale.

Problems which have hitherto hindered development in a commercially viable metal is difficult to find an alloy with adequate strength and resistance to oxidation, and the difficulty of producing vanadium on a commercial scale.

Planning models are now being selected in the development of special treatments for this purpose and indicate that the difficulty has now been overcome, that vanadium alloys will be produced on a commercial scale.

Most promising fields for the application of this metal are the aircraft industry and the nuclear engineering industry.

Vanadium, a very hard white metal, is only a little heavier than titanium and is intermediate between titanium and molybdenum in terms of its ultra-heat resistant physical qualities.

It was also proven a number of economic advantages over titanium in some industrial applications.

## SUB MINIATURES

Now you can get sub-miniature "key-locking" inserts in 0, 1, 2, 3, and 4 thread sizes. Sub-miniatures, made only by Kelox, offer design engineers the opportunity for saving space and weight even smaller and lighter. Identified as regular Kelox inserts, these new "key-locking" sub-miniatures will not corrode or loosen with vibration... provide maximum holding power... save weight and space.



## SAVE WEIGHT...

## SAVE SPACE

## with KELOX®

The Kelox system of threaded and tapped inserts offers the ultimate in weight- and space-saving design. Maximum holding power between parent and loaded parts is obtained because patented "key-locking" produces no stress concentrations and permits complete use of external threads. Independent laboratory tests have verified that "key-locking" successfully withstands application of maximum torque.

Low cost, easy-to-install Kelox inserts are available for external thread sizes from 0 to 3 inches. Made of many materials (dry steel, corrosion-resistant steel, brass, aluminum alloy, monel, etc.), Kelox inserts are also available with thin or thick walls for use with various materials—aluminum, magnesium, "soft" metal, plastic, titanium, steel, etc.



## EXTRA LARGE

For big assemblies, Kelox offers large inserts (up to any specified diameter) give unexcelled pull-out tension—just far more than that enables the avoidance of Kelox exclusive "key-locking" principle. Only Kelox offers you a positive, non-rotating insert that does not break down production costs, like cement—requires no special threads... gives maximum reduction of space and weight.



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## Naval Research Evaluates Man's Limits as Aircraft Control System

Man's abilities and limitations when part of an aircraft control system were examined by Max Land, DRDC, of Naval Research, in his lecture, a recent meeting of the American Association for the Advancement of Science, in New York.

Land, comparing humans to other birds, which share the aircraft control loop, Land evaluated man as three control functions.

• **As a sensor.** Man can see, at a distance of 100 miles. He can hear, only by actual vibrations, more rapidly than he can by ear.

He can even (in some instances) feel vibrations from the controls of an aircraft, enabling him to continue to maneuver successfully. In fact the sensitivity of both the eye and ear is close to the theoretical limits for resolution of a physical system, Land said.

Unfortunately, man's response times are long (10-250 milliseconds), his sensitivity ranges limited in head position, frequency range, and he becomes easily confused when simultaneously subjected to multiple inputs.

But, concluded Land, man is sometimes doing jobs which actually are beyond him to do. He works on a carrier deck, despite 14-15 G's noise. He flies high and fast where the effects of angle of attack and g-forces would cause him to lose consciousness, to prevent him from seeing the "buffs".

As an example of man's effectiveness as a sensor in the aircraft's guidance loop, Land cited the pit plane, which flies through a formation of pit walls and among them. This was probably referring to the aircraft which has been published in the press and was filmed by USAM concerning the single H-1 which flew through the formation of four B-47's coming out of a turn at 100 miles an hour in its wing. The only recovery information available to any of the five pilots was a modification by use of the pit's who said that their land legs were "squeezing".

• **As a computer.** As a computer man works exceptionally well. In controlling a hovering helicopter which is dropping some equipment, for example, a pilot can maintain a fixed position which enables him to see the exact recovery of 12 capsules of data by a computer. Even if the same signal is 10 or 17 dB below its random noise, he can use it to control and by extending the signal envelope, results. But whether he is listening to actual data or a school of fish, a hole or a submarine.

Although his memory of sensory functions and his speed and accuracy at numerical computations is poor, man remains the only known computer which can solve problems in logical sequences.

Man's motor responses (muscle movements) are limited to a few beats per second (10 or so) or less (on a typewriter). The motor responses have a bandwidth of about 10 cycles per second, with the natural frequency of about 1 to 1 1/2 cps. An important fact, an experimental bioengineer, had its wings torn off when the natural frequency of the wings became comparable with the pitch rate natural frequency in moving the controls, Land said.

### Man Very

These characteristics within the three functions discussed are common to all man in one degree or another, Land said. "It must be remembered that man was made in this capacity, body, mind, training and skills. Used quickly, control is utilized in the experience of new models of the human being, the engineer should design systems which can be used adequately by

not, members of the population likely to use it."

Even if a control job is well within man's physiological abilities, it may not be acceptable to him for psychological reasons. If it bore him, Land said, he will not want to do what is well within his limitations.

### Man's Limits

Whether man will be a detriment or a victory depends on what he is required to do, Land said. "It is obvious that he cannot exceed limits beyond the limits of his strength. He cannot see, hear or feel a signal if the background control completely masks it or noise. If he is overloaded to a point, he cannot manipulate controls that are 10 or more inches away. If he is expected to respond to several messages at the same time, he will be unable to get much anticipation from them."

"In an engineering psychology, do not see these as human limitations but rather as examples of poor system design."

If a system is properly designed, we need not worry about limitations. We can take advantage of man's unique abilities, the Academy which is not his only being subjected to a machine, his ability to separate signals from noise, and his ability to make decisions in complex and changing situations.



Plexiglas Gauges

Photo below shows a pilot's view of the cockpit of the F-104 Starfighter. The plexiglas gauge below the pilot's view of the cockpit is the only one which can be used in a cockpit. The plexiglas gauge below the pilot's view of the cockpit is the only one which can be used in a cockpit. The plexiglas gauge below the pilot's view of the cockpit is the only one which can be used in a cockpit.

acceleration...

another

barrier

conquered!



Research and design engineers have now successfully overcome the problem of high acceleration forces resulting from shock, vibration and centrifugal force which impairs performance of men and equipment alike.

The control of aircraft fluids under these conditions is no longer a problem even in the most advanced aircraft in terms of speed and maneuverability, because centrifugal force requirements because the order of the day at General Controls even before World War II when the engineers began developing a line of aircraft controls to meet the needs of high maneuverability.

Now with models that can take up to 300 "g" parameters, this extensive line of controls for aircraft fluid systems is satisfying the requirements of today's industry designing tomorrow's aircraft.



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Only vehicles they called it: the art of motoring. Today, with the first steps of space exploration, rocket propulsion is an engineering discipline, an applied technology and an essential activity. The applications for propulsion devices are unlimited, the possibilities unlimited.



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Physicists  
Multidisciplinary  
Technical Editors



Write: Director of Recruitment and Engineering Personnel, Box 2946, Alaska, Calif., or Box 79178, San Francisco, Calif.

## THRUST & DRAG

Chickens continue to abound in engineering papers, and one of the finest (and longest) examples of the usual rectangular chicken is this one, presented to be here reproduced in detail and on the telephone by an executive of a major manufacturing company. Speaking of his company, I recent entry into a specialized field, he said that the reason the company got in was because it didn't want to fall victim to the north while the pants passed by with someone else moving the ball past all the roadblocks.

The problem of the basketball that shouldn't have been but always did has been one of the classic conundrums of the aircraft industry. It has been used against every preceding arrangement

of one thing or another to question his calculations.

Having been an aircraft engineer whose calculations have been questioned, I find it was felt rather kindly toward the man who first presented the basketball machine.

It turns out that he was a Frenchman named Mignone, a mathematician who having nothing better to do, calculated basketball flight on the basis of aerodynamic theory—presumably, steady-state aerodynamics.

The results showed that all basketballs should be grounded that day, because the independence he had of Frenchmen extraneous, just kept on being and being.

Actually, Mignone had made the mistake that every aerodynamicist has made at one time: He used the wrong theory.

Then doesn't it seem an odd thing, except that basketballs can fly, aerodynamicists can be wrong, and Mignone was to blame for the contrary opinion.



**LINKS F117-T TIGER**, electronic flight simulator is packed away in a 40 ft. long trailer. Aerjet cockpit section at left is hydraulically mounted to simulate rough air and buffet motion. At center is instructor's console followed by computer section and maintenance test area.

## Link Expands in Simulator Field

Link, Aerjet's experience in the electronic flight simulator field enables them to mount or transport systems for simulators for both military and commercial aircraft.

- **General F117-T Tiger** supersonic fighter—first of two full-scale flight simulators has just been delivered to the Navy. Called Operational Flight Simulator Trainer (OFSST), the device was built under a contract with the Navy Training Devices Center, Port Washington, N. Y.
- **General Voyager F117-T** Canadian jet-powered supersonic fighter under production for the Navy.
- **General F-105A** supersonic interceptor fighter being produced for the USAF.
- **General F-105A** supersonic interceptor fighter also being built for the Air Force.

In addition, the company is making a Radar Signal Simulator (RSS) for the Air Force's Martin T48-G3 Blatador plotter bench. The simulator sends in a signal to trace incoming and outgoing events.

In the commercial aircraft field, Link rents their coaches:

- Boeing 707 in-flight simulator
- Lockheed Electra (shooting) trainer
- Douglas DC-8 in-flight simulator.



*Heron's Aeolipile*

## Heron's Aeolipile

In the 3rd Century B. C., 2,000 years before Newton's Heron of Alexandria anticipated modern concepts of jet propulsion with his working model of the aeolipile, a steam-driven forerunner of today's rocket engines.

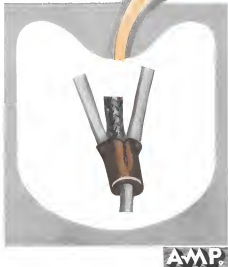
Heron, Newton, Goddard, von Karman—the principle endures, the need evolves, the powerplant is born. In our time, Aerjet-General Corporation represents the culmination of research, development and manufacturing in rocket propulsion.

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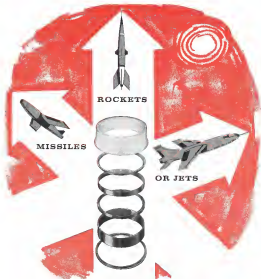
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## EQUIPMENT

# Trainer Stresses Completeness, Low Cost

By George L. Christian

New York—Aircraft production man—must complete these smaller models but less complex and expensive than simulators—has been designed and built by Barnes-Rodgers Technical Training Aids, Inc. Cost is approximately \$115,000.

Trainer is a dual purpose device, adaptable to the Douglas DC-6A, left motor cowl plate and the DC-7 post design transport. The device was developed for use by American Airlines in its flight training program.

### Recent Installation

American installed the first unit recently at its Los Angeles flight training base.

Two others are being installed at LaGuardia Field, New York and at Fort Worth while a fourth is scheduled for installation at Chicago.

Barnes-Rodgers believes its trainer will spell economy for both commercial and military users.

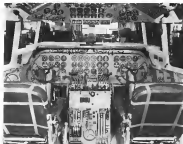
Because the trainer does not include actual live simulating navigation and actual flight maneuvers, the cost, complexity and weight is considerably reduced compared to a full-fledged electronic simulator. Result is that several may be placed at strategic locations along the route of a major airline saving travel time for crews to be trained for smaller airlines which cannot afford the \$500,000 or more that simulators cost. The procedure trainer offers an economical means for flight crew training in an efficient, inherent, unobtrusive.

Also, since procedure trainers are cheaper to transport and maintain than simulators, they can be used in many cases in all phases for which they are designed, such as engine inspection, engine and propeller operation, and fuel management. This allows the more expensive simulator time to be spent more effectively on checks which it alone can perform, such as navigation and actual flight handling characteristics.

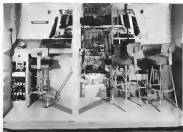
### Dual Purpose Trainer

Noted (and unobtrusive) feature of the new trainer is its ability to serve as a procedure trainer for two different aircraft with certain important differences in cockpit controls and instrumentation.

Controls which differ from one plane to the other include engine blowers, door handle and various switches. To take care of the differences, both sets of con-



COCKPIT of B-1B DC-6A/7 procedure trainer shows faithful reproduction of all controls, instruments and general configuration.



INSTRUCTOR'S SEAT, located behind the cockpit, is shown at left. Two observers seat are at the right.

trols were built into the trainer and passages were made to remove, cover, or otherwise render inoperative the in-applicable set of controls.

To solve the problem of simultaneous two differences, the conflicting dual were mounted back-to-back, on a pivot

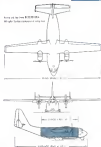
to allow quick reversal from one to the other.

So simple is the conversion from one type of cockpit to the other that total changeover time is less than five minutes.

The procedure trainer is designed to



## The first Pantobase BLC transport



The usefulness of military transport aircraft has been extensively increased with the introduction of the Shoukoff C-134. Produced for the United States Air Force this rugged heavyweight requires extremely short take-off and landing runs and can operate from any surface—land, sand, ice, water, etc. Advanced airframe design has been combined with Shoukoff Pantobase and Bendix-Layer Control Systems to produce a new type of aircraft equipped for a variety of assault and logistic missions requiring operation without the limitation of conventional runways. The Shoukoff C-134 is destined for an important role in modern military strategy.

Joining up opportunities for qualified engineers in many fields exist at Shoukoff.



Extending the Frontiers of Aircraft Performance

# Shoukoff

AIRCRAFT CORP.  
WEST TRENTON, N. J.



FRONT VIEW of the DC-6477 turboprop engine. Large exhaust in front of the engine houses the four engine nacelles. Exhauster's exhaust is behind nacelle.

each both normal and emergency operating procedures and the computer, which is direct will duplicate.

•Engine operation (including start, stop, run up, slow start, and light operation).

The latter includes operating changes due to altitude variation. Maintenance which the assistance can get into the machine include:

Ignition failure, supercharger malfunctions, instrument failure, and power loss.

•Propeller operation—governing, re-connection, feathering, unfeathering

and prop control, and the failure affecting these operations.

Some of the other systems which are completely capable in the future are: control in the maintenance facility and d.c. electrical systems normal and emergency hydraulic systems, vacuum system, all heating and cooling systems, the warning and lighting systems, water systems, engine fuel system, including fuel heaters, cross feeding and tank selection and the advisory system.

The device is designed for quick disassembly and one shipping. It can be broken down into eight sections, more than 6000 in. of it can be in use.



Mollory-Sharon Plant

Aerial view of Mollory-Sharon facilities at Niles, Ohio, including various buildings, parking lots, and other structures. New building plant addition in Mollory-Sharon to length of two football fields. It will house electronic equipment now being installed. Shoukoff also is going up at site for new quality control laboratory.

## Want to save weight?

FINN lightweight mounting bases could save 7 1/4 lbs. on the B-52



FINN lightweight mounting bases could save 5 1/2 lbs. on the F-102



FINN lightweight mounting bases could save 5 lbs. on the F-100



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### Arctic Tire

The tubular tire has been tested in a cold box for 24 hr. at a temperature of -60°F. It was then "loaded" on a dynamometer wheel at speeds equivalent to 180 mph, and the casing remained airtight, showing the tires' cold weather capabilities. The tire was developed by Goodyear Tire and Rubber Company's Arctic Products division working closely with Wright Air Development Center. The company is now in open the production of the tubular, cold weather tire for the military.

a ratio of 3:2, which gave a weight saving of 9.6 lb.

A vacuum-assisted dual oil valve closes the nose gear steering circuit when the pilot's weight is no longer supported by the wheel after takeoff. This prevents inadvertent operation of the steering system when in flight.

The first CL 25 is scheduled for flight testing in April.



### Small Tape Recorder Used for Evaluation

Control Air Defense Force with head quarters at Grissom AFB, Mo., is placed the long-used, low-cost, with a rugged tape recorder for pilot flight evaluation. Known boards are improved during bad weather and blackout operations because of the close proximity being required for evaluation which



## How the Holley three dimensional cam functions as an automatic co-pilot



The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so constructed that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the

Equator and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.

Typical "brain center" of a Holley direct engine control. Note the distance modified surfaces. Each plays a vital role in automatically regulating the engine under varying conditions.



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Kaman again pioneered  
in the heli-  
copter gas turbine  
field with this HOK  
powered with two  
turbines.



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## WHICH OF THESE PROBLEMS FIT YOUR FIELDS OF INTEREST



Bell Aircraft is continuing its pioneering in the fields of research aircraft and weapon systems. Testing techniques and equipment soon be developed which will establish design acceptability of modern new developments. The range of testing covers all prototype weapon systems and aircraft elements. Here are just a few problems typical of those we are now encountering.

1. Give the conditions for thrust chamber operation of a solid propellant weight loss of 30 lbs per second and a mixture ratio of 5 to give a chamber pressure of 500 psia when new test processes would be required for a mixture ratio of 4 if the original tank pressure were lost from 1,000 psia to the ambient tank, and 900 to the test tank.
2. In the design of a radar range indicator test set, a digital counter with a frequency division of 437 is required. The circuit to be designed must operate properly under the following variable test conditions:
  - 1) Power supply voltage is 200 V, 100 volts DC.
  - 2) Thermal supply voltage is 4.5 V, 5 volts AC.
  - 3) Temperature range: -100° C to +40° C.
  - 4) Shock up to 30 g's.
  - 5) Frequency range (center input) up to 1,000 Mc/s.
3. Running test planning and group testing of varied projects involving critical airplane components and electronic systems for flight control and navigation.

If your qualifications place you in a position to help solve these challenging problems, or if you are now involved in the scope of your opportunity and would like to participate in any of Bell's widely diversified activities in other fields, write today. Manager, Engineering Personnel, Department E-1, BELL AIRCRAFT CORPORATION, P. O. Box 288, Buffalo, N. Y.



keeps the pilot's eyes out of the cockpit most of the time.

At first, the recorder's line was hooked into the pilot's instrument-two wires. Meanwhile, of impedance or excessive single line power in the system produced a loud hum on the recording.

Solution was found in a loop of 200 feet of No. 40 enameled wire coiled around a 1 1/2 in. diameter plastic form. When placed on the tapehead inside the pilot's helmet it dissipated the instrument impedance problem. With this setup, the pilot can transmit to the recorder without having to go to the air.

Total cost of the required pick plug and wiring is less than \$10.

### Minneapolis-Honeywell Supplies F-27 Systems

Fuel management systems to be installed on Fairchild's Fokker F-27. Franchise will be supplied by the Minneapolis-Honeywell Corp.

The equipment will include recently developed light weight equipment fuel tank, vent and tank and component lines.

The system's indicators will be transmitted.

Among new systems which will use Honeywell fuel management systems as standard equipment are the Lockheed Electra turboprop and Boeing 747 jetliner tri-jet.



### Three-In-One-Truck

This Model M Low Lift truck will do three jobs: handle various pallets with fork extensions attached; carry standard air pallets with extension removed, and handle coil loads with hinged extension (not shown out of load) lowered on forks. The attachments are available in a wide range of sizes and are adaptable to any pallet-type truck. Manufacturer: Lewis-Shepard Truck, Inc., 123 Walnut St., Waltham, Mass.

### Bridgeport Thermostat Opens \$2 Million Plant

A new, 52 million manufacturing plant was recently opened at Milford, Conn. by the Bridgeport Thermostat Division, Robertshaw-Fulton Controls Company.

The 350,000 sq ft plant uses three double the size of the company's previous factory, will produce complex precision instruments, components and associated control systems for jet aircraft, automobiles, home appliances and many other applications.

Plant facilities include a special treatment installation, complete with two settling ponds, which treats chemical waste to prevent pollution of local streams.

Current employment is over 600 persons.

### Compromise Increase ends Hiller Strike

San Francisco-Milwaukee strike which ended a two-week production stoppage at Hiller Helicopters, Palo Alto, Calif., ended with agreement on an immediate 12 cent hourly wage hike across the board.

New 24 month contract with Lufkin, 1977, 1980, calls for another 7 cent an hour raise Nov. 1, 1980. Insurance benefits equivalent to 5 times job hour to be paid.

The immediate increase leaves average wage to \$2.56 an hour.

### Test Stands Made for Pressure Leakage Tests

Thrust eight test stands to check jet craft engines for pressure leakage will be manufactured by Cretz Hydrotest, Inc. for the Navy's Aviation Supply Office.

The units will be put into service aboard some of the Navy's largest air wing and at a number of Naval Air Stations, among them Norfolk, Portsmouth, Corpus Christi and Alameda.

### Airwerk Corp. Appointed DeLo-Reo Distributor

Airwerk Corporation has been appointed distributor for DeLo-Reo—French electronic components in all states East of the Mississippi River. DeLo-Reo equipment, such as igni-tion components and spare parts, will be available from Airwerk's main warehouse at Milford, N. J. and through the company's branch offices at: Alameda, Va.; Atlanta, Ga.; Cleveland (Ohio), Miami, Fla. and Newark, N. J.



## NEW "NO-MAG"

### NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PERFORMED CONSTRUCTION



### Eliminates Instrument Interference!

As just as we reported, many aircraft designers were interested in the recent announcement of our new non-magnetic aircraft cable. If you did not see it, "NO-MAG" has those characteristics:

**NON-MAGNETIC PROPERTIES**—"NO-MAG" cable is made from type 304 stainless steel. It resists magnetic induction and does not work in—

—in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetic induction after magnetic wire drawing or similar operations.

This non-magnetic property of "NO-MAG" cable eliminates instrument interference from cable magnetic fields.

**CORROSION RESISTANCE**—New "NO-MAG" cables have non-corrosion-resistant qualities similar to, but slightly better than, cables made of standard stainless steel.

**GOOD THERMAL CHARACTERISTICS**—The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables.

**USE WITH SWAGED TERMINALS**—Swaged terminals can be applied to standard air dimensions.

**COMPLETE RANGE OF SIZES, CONSTRUCTIONS**—New "NO-MAG" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

Get the complete story on this new technical development. See this new "NO-MAG" industry. Write today to Detroit office.

ACCO



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AMERICAN CHAIN & CABLE**

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## New Radar Range Readied for ARDC

New flight but range, collecting a class of radar systems, is being constructed for the Air Research and Development Command at Edwards AFB, Calif.

Range, which will extend from Rogers Dry Lake 430 mi. (near Nevada), will be operated by ARDC's Air Force Flight Test Center and the National Advisory Committee for Aeronautics' High Speed Flight Station in testing and developing new aircraft.

Three of the radar systems will be

located at specially constructed stations and a fourth, a mobile station, will be installed in a large dead-end tunnel.

Radio-navigation system are being built by Raytheon Instrument Corp., subsidiary of Raytheon Corp. of America, at a cost of about \$1,250,000. Equipment is scheduled for delivery next July.

## Dual Feathering Lines Go on Constellations

Dual propeller feathering lines for added safety will be installed on the

Wright R1770-1A-2 engines which will power the Lockheed Model 1049 Super Star Constellation will be delivered to Trans World Airlines sometime this spring.

The dual lines will lead from the propeller feathering pump, located behind the fire wall, around the engine's rear bank of cylinders to the pump governor that is mounted on the nose cone.

Should cylinder failure destroy the integrity of one of the lines, the remaining line will supply the oil pressure (about 700 psi) necessary to feather the propeller.

A series of check valves will prevent any loss of oil through the ruptured line.

The dual prop feathering lines are supplied by Rotax-Lo Corporation.

## OFF THE LINE

A new series of Mothesat Test Gages, capable of holding a maximum reading after the load has been removed, has been developed by The Hunter Spring Co.

The new gages are very similar to the company's standard Series D line



(AVR Nov. 12, 1956, p. 65), have stress strain load capacities of 75, 100, 150 and 200 lb. They feature a single control button placed above the dial, which allows the gage either to follow all load applications or hold the maximum load reading.

Order for over \$14 million worth of electro-mechanical instruments has been given Air Associates by Lockheed Aircraft Corp.

The units, designated M-716101, will be used on Super Constellations as control system.

Special elastic loading back frames, being approximately 50 in. in length, will be built for the USAF by Freshfield Truck Co., under a subcontract from Douglas Aircraft Company. The frames



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HEINEMANN Circuit Breakers—complete with your choice of inverse time-delay curves or instantaneous trip—are available in current ratings as low as 0.010 amperes . . . an important fact to remember when considering the protection of sensitive equipment.

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The familiar name that identifies each dash latch and hinge built by HARTWELL is more than a mere trademark.

To us this one word—HARTWELL—on our product symbolizes a challenge—a challenge to continue building and producing to the highest standards of quality and performance required by the aircraft industry.

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### SIMUL-CONDUCTOR DIVISION

Write to: Mr. V. Jennings, Dept. G 3000 E. McDowell Rd., Phoenix, Ariz.



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their location. On interview we found the job we wanted was in another part of the country entirely. Worst location is a strong point in recruitment advertising, what happened to us in this advertising?

Of the 100 engineers interviewed, more than 100 said they wouldn't answer an ad giving a bee number; more than 200 said they wouldn't want to work for a company that stresses its location because they'd get lost in the shuffle.

It was consequently agreed by 100 engineers and 200 students that, while we enjoy the beautiful location, we're not taken in by them. Opening of a company is based on the way the personnel department handles applications, whether they answer specific questions and whether there is any indication that the personnel department works with the engineering staff.

### What Engineers Want

These are the things that are confusing us, the things we don't like. But there are many things we do like—at least 50% of us do—and we are further confused because they aren't being said.

- For instance
- We like long distance telephone calls to clear up parking questions.
- We like personal letters that answer our questions.
- We'd like our transportation and expense for answers to be paid for in advance, or at least arrangements made with an airline for change accounts.
- We like it when companies talk our language. Of more than 900 ads submitted, only three were written by and for engineers.
- We prefer to work for companies with engineers in administrative positions because we feel that with engineers in charge there is less chance of waste of engineering talent. Students particularly want to work for an engineer-managed company so they can get around the baggage of being told in senior positions. A few companies mention "engineer management" in their ads. Most of them don't.

### Other Engineering Lents

We've all had "an jan alit" thrown at us from all angles, and of course we've relocated in locations, climate, leaving good schools, company-type word educational programs, etc. But there are other ways we can be hurt, and we're surprised that they haven't been tried.

Instead of a large, terrible salary, couldn't we get a small terrible salary, and a large, non-terrible per diem? Couldn't we get company automobiles for private use? Profit sharing? Stock purchase plans with company matching one for two, or one for one, or one for one.



The California Division of Lockheed has a special position. It doesn't limit itself to a few types of planes. It develops virtually all types—cargo and transport, extremely high-speed fighters, radar search planes, jet trainers, patrol bombers and others still classified. And it takes a constant flow of new design ideas to feed this ever-expanding program.

Do you have new ideas? They'll get attention at Lockheed. Your future relationship with us is certainly worth exploring. Perhaps the most convenient method for you to take in contacting us is to write, K. W. DeLozier, Manager, Professional Recruitment, or send in the brief résumé form below.

### California Division

## Lockheed

Aircraft Corporation, Burbank, California

U. W. DeLozier, Dept. NG 34-B  
Lockheed Aircraft Corporation  
Burbank, California  
Dear Sir: Please send me your brochure detailing life and work at Lockheed

Name \_\_\_\_\_

If you are an engineer, please state your field of engineering \_\_\_\_\_

Please insert address \_\_\_\_\_

City and State \_\_\_\_\_

Home phone \_\_\_\_\_

100 (depending on market value). Retirement plans are fine, but we feel a really progressive company should tell the world that retirement at 65 is not necessarily automatic. If a man's profession is in demand, he shouldn't be forced into retirement leave.

We'd particularly like to feel that a company's left hand knows what its right hand is doing. In housing the effectiveness of magazine advertising, companies put in writing "I received 100 replies to our ad and hired 10 engineers."

Engineers would like to say, "I received 10 concrete offers with a minimum of fuss and accepted one." But we're not always given the opportunity. We're forced down at our project

without any relevant advantages or credit to modify. A home office says "no!" and individual projects say "yes!" Engineers aren't acknowledged, engineers aren't rewarded, engineers are rewarded as interviewers.

Of the 100 engineers and students who were interviewed, almost all of them said they'd like to be 10 years later, they'd like to select the right company the first time and two years later, be working for the same company in an advanced position. This is only possible if we can stop moving carefully before we take job number one. If we can't, we take whatever is offered, and stop around a year or two later, decide leaving, and the company a great deal more money.

## Some Engineers Turn to Unions As Answer to Their Discontent

Engineering unions claim 60,000 members out of the nation's 500,000 engineers according to a recent study by the National Industrial Conference Board.

To find the roots of discontent which are driving unmanageable profits quickly into organized trade unions, the board questioned company executives, engineering union officials, engineering students and individual engineers.

Chief complaints were:

- Financial problems
- Professional status
- Lack of individual treatment

Engineering students and unions disagreed about the solution to the engineer's problem but, in general, they agreed about what the problem was. The societies are dissatisfied with them from the disorganization of the personal relationship between engineer and employer and the consequent ineffectual treatment of engineers. The solution lies against us.

- Recognition as part of management team.
- Less frequent assignment to jobs requiring little engineering ability.
- Classification with professionals rather than non-professionals.

The engineering societies believe unionism is incompatible with the engineer's professional status. They point out that unionism can improve employment standards.

The unions believe that unionism is in answer which often specific solutions to the engineer's problems. They reject that engineers are joining unions to regain lost professional status.

A widely reported complaint by engineers is that the income differential between engineers and hourly wage earners is disappearing. One of the

most reported reasons for this is that the latter are organized.

A somewhat similar complaint is that the income gradient between such kind engineers and experienced engineers is not steep enough.

This is because the limited competition for engineering graduates leads companies to offer attractive starting salaries before those which would ordinarily go for pay raises. Highly colored advertisements for engineering help by recruit companies are blamed for making engineers discuss their work with their parents.

To its report the board outlined the background and extent of engineering discontent. It listed three types of unions which engineers are joining:

- **Industry professional unions** such as the American Union of Technical Engineers, AIT, CEE, etc. They claim over 15,000 members.
- **Production workers' unions** such as United Automobile Workers, United Steel Workers, International Union of Electrical Workers. They claim a substantial number of professional outdoor engineers.

## Air Kruise Starts Combination Service

London's new combined bus, air and rail service linking England with France, Spain and Italy has been announced by Air Kruise, an independent British carrier.

Known as the Blue Arrow, the service is to start in the spring.

Passengers will travel by bus from

## To the ENGINEER of high ability

Through the efforts of engineers The Garrett Corporation has become a leader in many engineering fields, components and system fields.

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- air conditioning
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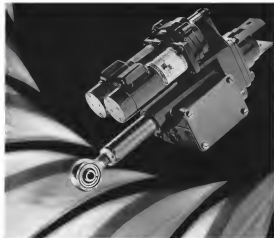
The Garrett Corporation is also applying this engineering skill to the steadily important mobile system fields, and has made superior advances in power engine development and in design of turbochargers and other industrial products.

Our engineers work on the very frontiers of present day scientific knowledge. We send your course folders and offer you the opportunity to progress by making full use of your available ability. Positions are now open for development in:

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- chemical engineers
- electrical engineers

For further information regarding opportunities in the Los Angeles, Phoenix and New York areas, write today, including a resume of your education and experience.

Address Mr. G. D. Bradley



## Four-speed actuator

AirResearch two-motored unit provides automatic control plus an instantaneous manual override at the work end of its Air Data System.

During high speed flight, where control is so delicate it is often by five tenths of an inch, manual override response under emergency conditions is of critical importance. The actuator shows a clear immediate pilot override of the automatic system without any disengagement or mechanical clutching device. If necessary any use of four speeds may be instantaneously selected.

The unit operates with complete dependability at ambient temperatures up to 300°F. Additional actuators operate on split field or permanent magnet DC motors, on AC servo motors or on single phase, three phase or three phase AC motors. They can supply feedback signals to the control and be provided with neutral positioning and hystereticities.

We are now engaged in the development of Air Data Systems of all types, ensuring full system responsibility. Because we manufacture the entire system, including transducers, computers and actuators, you are assured of the utmost in system compatibility.

Outstanding opportunities for qualified engineers. Write for information.



Design and manufacture of aircraft systems and components, automotive systems, electronic systems and systems, powerplants, engines, turbochargers, compressors, pumps, valves, actuators, control systems, instrumentation, test equipment, electronic equipment and systems.

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## Automatic Control Systems

for tomorrow's needs and hypersonic speeds

Ten years ago—when AUTONETICS began its work—many people had looked and to be shocked. The task of developing guidance and control systems for the Air Force SM-58 Nike-Ajax missile. Missile designers, engineers who could design, manufacture, test and produce in quantity automatic controls that would operate in environments and at speeds never before experienced.

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We have the facilities... among them a new Ames research building, which will have each of our conditions from 60,000 ft. altitude... where temperature variation is held to plus or minus 1°.

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IF YOU'RE THE MAN WE'RE LOOKING FOR... you have knowledge, enthusiasm and imagination—tempered with judgment. You're both research and production-minded—a dreamer and a doer at the same time. At every level of experience, you'll have an opportunity to conceive and achieve an idea. Then prove it—a better way.

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Robert E. A. Collins, chief engineer, has been with us for 10 years. During that time he has worked in our research facilities in the Ames research building, which will have each of our conditions from 60,000 ft. altitude... where temperature variation is held to plus or minus 1°.

## Autonetics

A Division of North American Aviation, Inc.

AUTOMATIC CONTROLS MAN HAS NEVER BUILT BEFORE



### Model 12-C in Australia

Little Model 12-C helicopter attracts considerable attention from designed children on its first visit to Australia's Cape York Peninsula. Helicopter belongs to Trans Australia Airlines and was chartered for animal research work (insert). Photo was taken at a mission station on the distant Cape.

London to Perthfield, by air from Perthfield to Lyons, France, and then to their destination by sea. A trip to New, for example, will take 17 hr. at a round trip cost of \$6 million.

A similar service by Silver City Airways took London by Bristol and Paris.

### Helicopter Pool for Australia Suggested

Melbourne—The Australian subsidiary of British Australian Company has submitted a scheme to create a special helicopter pool to meet emergency and other experimental requirements in Australia.

The detailed scheme was submitted to Federal and state governments.

Bristol is suggesting an initial purchase of six Bristol Synchrojet or similar helicopters to be used in rescue, rescue, and flood work, both for control as well as national security and development work.

The report suggests that the scheme should be managed by armed services or police companies.

Also suggested is a "national air guard" in which the helicopter with personal contributions from armed services.

It is believed the federal government is unlikely to consider the scheme in the near future, although the money obtained by airline operation with their experimental helicopters will lead to additional foreign orders in 1957, and the government will continue the new purchases and allocate foreign exchange.



### Borougan in Algiers

Modified Borougan air force (insert) Design, which the French call "Borougan," built at Toulon for the Air Force in Algeria with the photo. The Borougan is equipped with dual two jet engines and has the tail plane in position in front of the wings. It has four 28 mm cannons and can carry two 500 lb bombs in eight slots.

### ENGINEERS

(continued from Page 1)

## APL—An Organization Of And For Technical Men And Scientists

The Applied Physics Laboratory (APL) of the Johns Hopkins University is an organization of and for technical men and scientists. APL is organized on a horizontal basis; responsibility and authority are given in equal measure. Scientists and technical men occupy all decision-making positions, because our only objective is technical progress.

Because of its predominantly professional character, APL has kept its size small, having pioneered the proximity fuse, the first super-sonic ramjet engine, the Navy's Bombsight family of guidance which includes the TRAINER, TAG-60 and TARTAN, and is presently attempting break-throughs on several important fronts.

Occurring in this spirit of freedom from Washington, D. C., and Baltimore, Maryland, APL's new members allow staff members to select roles, undertake or reject projects, and either of these outstanding centers of science as a focal point for the long Baltimore campus, formerly with the staff of other D. C. organizations.

### OPENINGS EXIST IN

DESIGN/ANALYSIS: Physics and control analysis; missile engine design; preliminary design and wind-tunnel testing.

RESEARCH: Interference and heat transfer phenomena; internal aerodynamics; hypersonic, turbulent, shock wave phenomena; combustion.

Write for complete information. Your letter will be answered personally, in detail.

Write: Professional Staff Appointments

## The Johns Hopkins University Applied Physics Laboratory

1111 George Avenue, Silver Spring, Md.

## Publications Received:

"The Acroplane" Futural Review—by the Staff of "The Acroplane"—Feb. by Temple Press Ltd., Bedford Green Lane, London, E.C. 1, England. Approx. \$1.05.

Two hundred and eighty of the best photographs that "The Acroplane" has published during the past year are collected with text to provide a unique pictorial survey of the aeronautical scene.

Structural Properties of the Circular Fuselage—by Marcos Arana—Feb. by Progress Press, Inc., 306 Fourth Avenue, New York 10, New York. \$3.50, 21pp.

A handbook for aeronautical, structural, and mechanical engineers containing tables which show the values for every line diagram of air for the three figures which can be designated circular functions: the sector, the segment, and the fillet.

Three-Dimensional Flow in Axial-Flow Turbomachinery—by L. H. Smith Jr. Available from Office of Technical Services, U. S. Department of Commerce.

Washington 25, D. C., order PB 121 499 \$3.50, 14pp.

Thus in Volume II of the series showing means of prescribing blade shapes to give the desired flow distribution is available automatically. Volume I (PB 121 651), 14pp., \$3.50, is still available from GPO.

Civil Air Regulations in Plain English for All Pilots—by Sam R. Hamilton—Pub. by T. S. Denison & Company, 121 Fifth Avenue, So., Minneapolis 15, Minnesota. \$1.95, 91pp.

Specifically directed to the needs of airplane pilots, students, private, and commercial, this book is not a reprint but a detailed explanation of the actual flight rules that have been established by the Civil Aeronautics Administration.

Ryerson Steel Data—Prepared by Joseph T. Ryerson & Son, Inc., Box 6880A, Chicago 40, IL, and available from this address at no charge. 136pp.

The revised edition of this pocket-size data book gives helpful information on machining and fabricating, specifications and tolerances, weights and dimensions, elements and safe loads.

"Proceedings of the RETMA Symposium on Reliable Application of Rheology Tables"—Feb. by Engineering Publications, GPO Box 1151, New York 1, New York. \$5.00, 101pp.

Nature's experts present papers and discussions on such subjects as, "Effect of Rheology on Lubrication," "Design of a Reliable Flip-Top," and "Stress-Strain Applications."

Fleng Clubs Do Pay Off—by Jim Otteng, Pub. Williams and Katz Studio—Available from ESSECO, 3554 Linden Avenue, Alhambra 13, Ohio. \$1.00, 12pp.

Based on the experience of one of its authors, this booklet is a complete guide to the formation and operation of flying clubs.

ASTM Standards on Zinc-Coated Iron and Steel Products—Sponsored by ASTM Committee A-9 On Corrosion of Iron and Steel—Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania. \$2.15, 136pp.

This publication is intended primarily to present in a convenient form for reference the various ASTM standards and test methods for test and specification pertaining to various coated iron and steel products.

Manual of Consulting Practice for Mechanical Engineers—Prepared by the Committee on Professional Practice of Consulting Engineering of the American Society of Mechanical Engineers.



McDonnell Demons Refuel Aloft

First test of new night "bubble" refueling system developed by North Aircraft Corp. for McDonnell Aircraft Corp. is shown near St. Louis. For refueling of modern jet fighters of high speeds and altitudes, and under F108-1N (see p. 11), the bubble refueling system was developed. It is a new type of 200 gal. per hour. Fuel is transferred through a flexible steel hose which has a 90° bend at the tank. Hose was developed and built by Aircraft Components Division, Douglas Aircraft Co., Dayton, OH. It's a flexible construction that will stand still while refueled with a short or bent hose, designed to be moved without tank refueling systems. Navy's "bubble" concept of night refueling was exclusively revealed by Aviation Week (June 14, 1951, p. 35).

and available from ASME Order Department, 20 West 14th Street, New York 18, New York. \$1.50, 14pp.

Primer Education in the Air—Prepared by the David Grainger School of Aeronautics, New York University, College of Engineering, University Heights 15, New York. 5pp.

Commemorating the 10th anniversary of the Grainger School of Aeronautics, this booklet presents an embryonic and informative history of its development.

1950 Supplements to Book of ASTM Standards—Pub. by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. In seven parts, \$4.65 each, \$32.00 for the set of seven which are as follows:

Part 1. Ferrous Metals—440pp.  
Part 2. Non-Ferrous Metals—360pp.  
Part 3. Cement, Concrete, Coatings, Thermal Insulation, Road Materials, Waterproofing, and Seals—100pp.

Part 4. Paint, Naval Stores, Woods, Synthetic Materials, Building Construction, Pot Tests, Wax Products—130pp.

Part 5. Pulp, Porelones, Synthetic Elastoplastics, Resins, Adhesives—130pp.

Part 6. Rubber, Plastics, Electrical Insulating Materials—390pp.  
Part 7. Textiles, Spins, Wools, Furs, Adhesives, Shipping Containers, Atmospheric Analysis—130pp.

The IATA Facilities Policy Manual—Issued by the International Air Transport Association, Travel Centre Building, Montreal 1, Canada. 210pp.

Being distributed to the bookstores of IATA member companies, the manual is a world-wide reference on ways to cut back and time regulations affecting passengers, shippers and airlines alike.

Techniques for Making and Preparing Microscopy Slides—C. W. Kinsler, Jr., W. H. Reynolds—Available from GPO, U. S. Department of Commerce, Washington 25, D. C., order PB 121 282 \$3.00, 31pp.

Alignment Testing—by K. J. Hance—Pub. by Engng Engineering Co. (3) South Dearborn Street, Chicago 5, Illinois. 9pp.

Notes for Engineers—by C. D. Tinsley—Pub. by McGraw-Hill Book Co., 310 West 42nd Street, New York 36, New York. \$4.00, 193pp.

Proceedings of the High Temperature Symposium—by the University of California and Stanford Research Institute—Available from the Public Relations Department, Stanford Research Institute, Menlo Park, California. \$3.00, 21pp.

Thunderbolt—by Jack Williams—Pub. by Republic Aviation Corp., Farmingdale, Long Island, N. Y.

The origin of the origin and operation of the USAF's 5600th Air Development Group from known throughout the world as the Thunderbolt, one of the fastest piston driven fighters in the history of aviation. Written by the son of Wallace Corp. Major "AF" Williams, the newly published volume is well illus-

trated with flight and ground pictures and diagrams detailing the Thunderbolt maneuvers with their Republic-built straight and surprising 1-34 second.

"High Temperature—A Tool for the Future"—Pub. by Stanford Research Institute, Menlo Park, Calif. Available from the Public Relations Department of Stanford Research Institute, Menlo Park, Calif. \$5.00 postpaid, 131pp.

The High Temperature Symposium was jointly sponsored by Stanford Research Institute and the University of California. The three day meeting, held on the campus at Berkeley, June 15, 16, and 17, attracted approximately 600 delegates from throughout the United States and several foreign countries. The conference dealt more broadly with the different phases of high temperature research than any previous conference.

Some 36 papers participated in the three major categories of discussion: methods of reaching high temperatures, materials suitable for high temperature use, and processes occurring at high temperatures.

ASTM Methods for Chemical Analysis of Metals—Pub. by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. \$5.00, cloth cover, 619pp.

The 1950 edition of this book is the most complete revision of the volume since 1939. It is essentially a part of the Book of ASTM Standards and contains all ASTM methods for chemical analysis of ferrous and non-ferrous metals and alloys.

# AERONAUTICAL INTERESTING APPLICATIONS IN FLIGHT RESEARCH OF WORLD FAMOUS SPERRY EQUIPMENT

## ENGINEERING TEST PILOT

with recent jet fighter or 4 engine experience. Engineering degree, and 2500 hours minimum flying time required.

## UTILITY PILOT

Commercial and instrument ratings required. Minimum of 2500 hours first pilot time, Seaplane rating desirable.

FULL EMPLOYEE BENEFITS  
RELOCATION ALLOWANCES

APPLY TO MR. E. STEWART

# SPERRY GYROSCOPE CO.

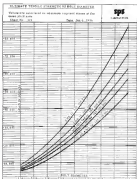
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**EWB-22 bolt is entirely new.** External wrenching bolt with threaded bearing steel pinhead, greater loading without indentation of bolted surface. Hex Hi Psi thread form, generous fillet under head, smooth internal surface increase tensile and fatigue strength. The EWB-22 locknut was designed with characteristics specially suited to the bolt.



## Build stronger, safer, lighter airframes with new SPS Hi Psi aircraft bolts

Conventional bolts were not strong enough to fasten jet-age aircraft now on drawing boards. So Standard Pressed Steel Co. discarded obsolete fastener configurations, materials and production techniques and designed a new high-strength bolt—the Hi Psi EWB-22—which is the strongest bolt made to date.

Compared with conventional 100,000 psi bolts like the MS 30004 Series, the SPS EWB-22 has 30% greater tensile strength and, at 5 million stress cycles, up to 90% greater fatigue strength. These qualities make it desirable, in most cases, to replace a standard MS 30004 Series bolt with an EWB-22 of the next smaller diameter. The benefits from use of the EWB-22—in increased structural strength and security and in reduced weight—are obvious.

Concurrently with the development of the EWB-22, SPS produced the Hi Psi EWN-22 locknut to complement the bolt. It is a high tensile strength self-locking nut with a 13-point external wrenching surface. It makes possible the high wrenching torque needed to preload the EWB-22 to the greatest advantage.

Along with Hi Psi EWB-22 bolts and EWN-22 locknuts come other new additions to the complete SPS line of threaded aircraft fasteners—PL-12 preload indicating washers, simple mechanical devices for accurately preloading the new high strength bolts. For detailed information about these products—or about your special aircraft threaded fastener problems—write to today: Aircraft Products Division, STANDARD PRESSED STEEL CO., Johnstown 3, Pa.

### AIRCRAFT PRODUCTS DIVISION

STANDARD PRESSED STEEL CO.

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JOHNSTOWN, PENNSYLVANIA

**EWB-22 is much stronger than conventional aircraft bolts.** These curves, with ultimate tensile strength in pounds plotted against bolt diameters, show that it is feasible to replace an MS 30004 bolt with an EWB-22 one size smaller. The EWB-22 is stronger in shear and in fatigue as well.



**THE THREE-ENDED** Hiller Flying Platform has quadrilateral control surfaces hinged under thrust.

## New Hiller Flying Platform

A three-ended flying platform prototype has been built in Hiller's laboratory under a \$500,000 contract for the Army. Most obvious feature from the sides: two-armed control surfaces hinged by the Chief of Naval Research is a ring of control surfaces mounted below the fuselage. These appear to be grouped together in a rigid spider. Plans to use the flying platform as a troop and supply carrier would make it impossible to confuse solely on weight shifting as a means of maintaining control. Deflection of downward by the new method may provide a solution. The pilot platform of the three-armed system is located higher above the fuselage and closer to the engine model.



**COAXIAL** line on left driven by 44 hp. two-cylinder engine offset to reduce placing of engine shaft vibration. Vertical surfaces inside shown are door panel controls.



**OPERATIONAL** design would carry four seated men. Thrustline control by shifting pilot's weight is impossible and any engine control surfaces below thrust (shown left)





## Eleven low-noise G-E tubes help Republic test planes for absence of radio interference!



With the aid of 11 General Electric GL-6299 low-noise, high gain triodes, Republic Aviation Corporation saves time and costs when monitoring fighter planes for radio interference.

The compact, 1-inch-long tubes are installed in the sensitive SRA-226 Noise Interference Analyzer developed jointly by Applied Research Inc., Flushing, N. Y., and Republic. Using this analyzer, quality-control engineers observe one-by-one the electronic components of a plane, then read an oscilloscope to learn if there is any noise interaction with radio receiver, radio compass, or other electronic unit.

Since the analyzer operates continuously from 225

to 400 megacycles, monitoring covers some 30 frequencies at once. Formerly each frequency called for its own job of monitoring. Time saved by Applied Research Inc.'s new method is such that one hour's testing at Republic now accomplishes what before took a whole day!

The low-noise figure of the GL-6299—under 5 db in 225-to-400-mc service—can give new capabilities to your equipment for testing, communications, navigation, radar, or other purpose. Ask a G-E tube engineer to check your new circuit for application possibilities! General Electric Company, Electronic Components Division, Schenectady 5, N. Y.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**



"scattered out" in 41 directions in the VTO field.

In 1975, after the Keros was built, the company was almost buried out of business. It was being asked: "you down to a first quality" building on this one, undisturbed?" It had been played for the military on a real front product they were making, the H-21A helicopter. In a management sense, Heller was making one sale on the board of directors of losing control.

The company was under financial, had inadequate production facilities—subcontracted 90% of its work—but let out 400 people, was ready to let another 500 go.

Without the acceptance by the industry that would secure contracts to keep it alive through production, Heller Helicopters had to make major changes in its philosophy and operations if it was to survive.

Giving its assets to date to its primary work in VTO, the company decided to return to its roots, but to diversify its capabilities. Heller Helicopters selected three VTO areas to expand: ducted fans, tilt-rotor propellers and small, remote air force base product, the helicopter.

At the same time that the company started sending out "exploring parties" into new areas. It set about improving up its basic line operations, redefining and strengthening its managerial team, improving its financial position, retooling its production facilities.

To implement this program the company, in 1975 considered a separate division for advanced research, heading it up with Frank A. Holloman, M.D., U.S. Army (ret.) and former Chief of Transportation, Department of the Army. A new 16,000-sq-ft building adjacent to the main plant houses a complex laboratory and shop for construction of experimental projects.

While Heller's studies in R&D have looked at its oldest business, the company is still primarily a production company. In 510 million gross last year it was up 40% to 60%.

Currently it is building the three-place H-21C used for training, emergency and reconnaissance by the Army and National Guard. Its commercial counterpart, the Heller H-2C, is used by private operators around the world. It expects to market the production R&D work next year, building volume in both. Important in 1975 production will be the H-21D, which Heller expects to start testing out next fall.

This is the first helicopter designed under the Army concept of lowering operating costs by extending range without payload. The H-21D will have a 1,000-hp engine and a completely new transmission system and

is designed for 1,000 hours service between overhauls.

Executive Vice President Edmund Heller notes: "We hope to achieve a breakthrough in production now in the R&D stage and indicate to industry that we can compete on the basis of competitive bid. We wanted the plant to be as flexible as possible, so that under maximum business conditions they can keep their work in their own plant, keep their employees working. The company, he believes, holds its own retail blades, blows its own compass for the H-21 and H-22, has made the plastic industry, the rubber of its European work in both structural and non-structural parts.

Heller has accomplished the 70-70 ownership ratio in a fairly short period of time, the company has never paid a dividend and most stockholders have been content with holding their equity.

The company has built trends in



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**SERVICE DELINEAS** of the T.S.O. with its supershielded Locomotives, is 24,500 ft. Large transparent area enables for good visibility.

*Ariztion Week Check Ride:*

## New Twin-Bonanza Is Smooth and Swift

He Robert Stanfield

New York—Boeing aircraft's new six-seater place E50 Twin Otter is a smooth-handling, swift, top-performing aircraft geared to high-altitude, over-the-weather flight.

Flight evaluations by AVIATION WEEK showed that E50 matched or exceeded BoeB performance and specifications for all things checked.

Model ERD incorporates two licensing C20000 ALAs horizontally opposed, overclutch sprockets on gear ALAs each of 490 cubic in. displacement, develop 547 hp. at 3,400 rpm. for takeoff, are rated 329 hp. at 2,200 rpm. for maximum continuous power.

By comparison, the earlier D50, with its Leaning CN36, developed 291 hp for takeoff and 255 hp for maximum continuous power.

### Twin installation

First installation of the supercharged engine was first tested on a Model 34 four-cylinder. Learning how to test the A1A6 for 91 hp at full takeoff power with no damage sustained at run-down, according to a Bosch representative. Firstout overhead time on the high-compression engine is 800 hr. But the company expects this figure to increase

Power plant systems and equipment are automatic in operation. Engines are equipped with Bendix PM3-78D primary carburetors, with automatic

Rob Stanfield

Aviation Week's Bob Stanfield seemed to fly as the former Carlson Field Training program of 1941. During World War II he flew C-46s, C-47s, C-54s, C-82s and C-119s with the North Atlantic and India-China divisions of the Air Transport Command.

Following the war, Stanfield put in two years with Eastern Air Lines and Northeast Airlines flying domestically out of the New York area on DC-3s, DC-4s and Constellations. Before joining NEA he served for six months with the Atlantic Division of MATS.

Most of his current flying is done with the Air Force Reserve as an instructor pilot.

Shankle has logged over 4,000 hours and has flown single and multi-engine personal and executive planes and transports. He holds a commercial license, single and multi-engine, with instrument rating and is rated a Senior Pilot in USAF.

**Altitude-compensated motor control.** Altitude-compensated maintains fuel-air ratio at optimum. In case of malfunctions, manual fuel-air control is no may be used.

Kings' cooling system is automatic, so coolant supplements tubes at back of manifold. Kings' oil temperature is controlled by thermostatic bypass valve in the oil radiator. Pressure gas primer button helps eliminate lead deposits in chamber by squirting oil fuel into cylinder.

Flaps are platinum plated.  
EMC wing loading at 7000-lb gross weight = 25.2 lb./sq. ft.; power loading at gross weight = 10.9 lb./hp. Load factor of 3Gs is designed to withstand in-flight loads of 28 tons.

Airplane used for war flight evaluation was N158E, Serial No. E24-03, a factory demonstrator. Flying with it was G. Allen Rausser, Beech sales representative.

Dry weight of airplane with optional equipment was 4,760 lb. With 1,100 lb. of fuel (280 gal.), 64 lb. of oil (5 gal.) and combined passenger baggage weight of 560 lb., the demonstrated LTO gross weight was 6,960 lb. before taking

Service ceiling of the Tatra-Bonanza is specified at 24,000 ft., with 100 ft. climb reserve. Single-engine service ceiling, with 50 ft. climb reserve, is 11,000 ft.



**FULLY AUTOMATIC** attractive idea provides easy access to coffee

570 ft. At 6,000 lb gross, this amounts to 15,000 ft.

Tow and light characteristics of the airplane are good. Large transparent areas, including pressurized side windows, made for good visibility. From either side of the cockpit one can look forward and see the vertical stabilizer topped by rotating beacons. Radio position control auto-wheel steering limited to 15 deg.

Turns in curve, with deflection 45 deg. either side of center, square corner halting of brakes and throttle.

### Swift Acceleration

The airplane went off smoothly at 85 mph, immediately reached single-engine speed of 98 mph, readily accelerated to 125 mph. Rate of climb was 2,000 fpm, with forward visibility or turning excellent during the climb. Climb power was 42 in manifold pressure, 3,200 rpm. At 5,000 ft rate of climb was 2,700 fpm, 445 in 125 mph, at 10,000 ft 1,900 fpm, 120-148. Only minor trim adjustments were necessary during climb.

Radder pedal mechanism is the EPO non-adjustable to give about 4 in. travel.



**ARMIST** honors booklet, which last posted it at night



**FOLDING DISK** Slaps into slot of any front seat

travel, making for less radicle pressure for same control

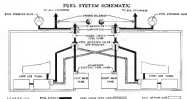
This was done to compensate for the increased power of the D50 over the D30.

At 17,000 ft. level flight, with temperature 6 deg. F., carrying 32 in. MP and 2,790 apm., the E58 had SAS of 219 mph.

Varflies trembled not worth for head-off flight. Imposed lateral stability and control is provided by vent-serve action of alarose tube. Flight alarose tab is anti-serve only. Left tab has both anti-serve action when alarose is moved.

and servo action, operated by train the control for lateral force

Propellers are Hartzell three-blade, full-feathering and constant-speed. Feathering is accomplished by pulling back on prop control past the detent to limit of travel. At 75,000 ft it took about 12 sec for the right engine to fully feather. With 75% power on left engine—31.50 in MAP and 2,750 rpm,—propeller took one minute to decrease to 170 IAS, in two minutes fell to 155 IAS, held steady at 140 IAS. Slow decrease emphasized clean lines of the aircraft. It was easily held by constant



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101 South Clinton Pike, Greenville, Pa.

## E50 Twin-Bonanza

High Speed at 5000 Ft.	130 MPH
Cruise Speed (75% Best Power at 10,000 Ft.)	220 MPH
Cruise Speed (85% Best Power at 10,000 Ft.)	215 MPH
Service Ceiling (Two Engines)	34,000 Ft.
Service Ceiling (Single Engine at 4000 ft. Gross Weight)	14,500 Ft.
Altitude Ceiling (Single Engine)	15,500 Ft.
Stalling Speed (One and Two Engines)	50 MPH
Stalling Speed (One and Two Engines)	50 MPH
Gross Weight	7,000 lb.
Empty Weight	4,400 lb.
Minimum Range (102% Power at 10,000 Ft., No Reserve)	1,650 mi.
Cruise Range (85% Power at 10,000 Ft., No Reserve)	1,310 mi.
Full Capacity (Including 30 Gal. Optional Auxiliary Tanks)	230 Gals.
Oil Capacity (14 Gall. Tank Total)	6 Gals.
Rate of Climb at Sea Level (Two Engines)	5,200 FPM
Rate of Climb at Sea Level (Single Engine)	2,400 FPM
Takeoff Distance (3000 lb. Gross Weight) Over 50 Ft. Obstacle	1,200 ft.
Landing Distance (3000 lb. Gross Weight) Over 50 Ft. Obstacle	1,400 ft.
Turning Manoeuvrability (Optional Jet-Cylinder Supercharged)	500/400/100
Stalling 340 ft. at Takeoff	
Base Price: P. A. Wings	\$49,900
(Performance See Government White Paper or Model 375)	

### ARMSTRONG

Cabin	178 sq.
Length	24 ft.
Wings	31 ft.
Height	24 ft.
Passenger Over Size	24/27 ft.
BAGGAGE COMPARTMENTS	
Forward Bag Size	21 1/2 x 39 1/2 in.
Forward Compartment Size	14 x 10 ft.
Air Door Size	24 1/2 x 39 1/2 in.
Air Compartment Size	14 x 10 ft.
Power Loading	200 lb.
AP Loading	300 lb.
AIRPLANE	
Wing Span	42 ft. 1/2 in.
Length	31 ft. 4 in.
Height	11 ft. 4 in.
WING	
Area	277 sq. ft.
Stalling at Gross Weight	50.14/50.12 ft.
Power Loading at Gross Weight	50.14/50.12 ft.

passengers until proper time was effected for land-off flying.

### Still Characteristics

E50 still characteristics are exceptionally good. Warning light flashed about 5 mph ahead of actual stall. Airplane buffeted well ahead of stall. At 11,000 ft., gear and flaps up, power off, a stall was accomplished at about 75 mph. With standard instrument, maximum altitude loss was 100 ft. Stall buffet was excellent.

Stability at 50 mph further increased as single engine stall at 11,000 ft., right engine cut, 65% power applied, gear and flaps up. With engine trimmed and with full oil radiator ports, wing ribbons control only, the airplane presented the stall by series of buffet. Warning light gave ample advance notice. There was plenty of time for recovery. Loss of altitude was negligible.

Due to inherent economy, the E50 will build up speed rapidly during descent.

Control as reported in use of the E50 is a dream. Maximum descent rate at 270 mph. After reaching 1,500 ft. altitude, the airplane cruised at 190 mph, 1/35 using 60% power.

### Short-Field Take-off

Short-field take-off was facilitated with 20 degrees flaps. Brakes were held while engines were taxed. When brakes were released, aircraft accelerated quickly, and was pulled off in about 300 ft. Single

engine speed of 90 mph was attained simultaneously with pull-off.

During short-field landing, aircraft was dragged in 160 ft., clearing over the fence at 90 mph. Slightly over 1,000 ft. of runway was used.

Fuel consumption, which will average about 100 gals./hr. and altitude, average slightly over 18 gal./hr.

This is somewhat higher than that of the D50, but is to be expected with the new supercharged high-compression engine.

Tank capacity at T50, including optional auxiliary wing tanks (25 gal. each) is 230 gal. Standard equipment includes two main tanks of 44 gal. each, two auxiliary tanks of 46 gal. each, for total of 140 gal.

### Maximum Range

Optional auxiliary tanks give the E50 a maximum range of 1,650 mi. in cruise.

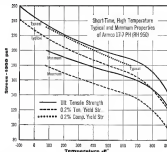
• Cruising range at 10,000 ft., with 65% of power and 185 at 115 mph (one in service) is specified at 1,640 mi. with 180 gal. fuel, 1,590 mi. with 150 gal.  
• Maximum range, one altitude (one removed) with 42.5% power and 160 mph 185 at 115 mph with 180 gal. (about 71 mi. fuel) 1,630 mi. with 150 gal. fuel (one 91 mi. fuel).

Optional equipment consisted of an air conditioner, one two light. Cores rotating buson windproofing auxiliary wing had tanks 108 sq. gals. propeller with oak, coach and Model 15

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Properties like these indicate why Armco 17-7 PH Stainless Steel is creating high interest among structural, power and aerospace design groups from coast to coast.

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The new heat treatment for 17-7 PH makes it one of the strongest aircraft materials available. Maximum tensile properties at room temperature are guaranteed. We are assured of this basic uniformity in a wide range of gauges and sizes in sheet, strip, and plate. Armco 17-7 PH is also available as the basis of bars, wire and bolts.

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Fabricated in the standard conditions, Armco 17-7 PH is readily formed, drawn and welded. After fabrication the



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properties shown above are developed by the simple RH 950 heat treatment. It consists of 10 minutes at 1750 F, air cool, —300 F for 3 hours; and 1 hour at 950 F.

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type rotating chair (replacing standard seat rails), and tail table.

Optional radio-telephone package "B" includes Nov 1016 transceiver, ARC HD Chorus, ARC V28 VHF transmitter, Flite Systems CNA radio antenna, Nov 1016 antenna, windshield and hoodlet.

Included optional radio equipment includes ARC Tics 21 AIO, three Tronics MR-3 motor beacon receiver, ARC HD Chorus (replacing dual Owen microtrans), and Weiss 7000 photo-scope access.

The demonstrator we flew, with its optional equipment, sells for \$108,170. Basic airframe price is less than \$100. Two thousand this year, \$50 per demonstration, at a range of \$307,000. FAI Standard model, including night flying equipment, landing lights, cabin heater and fuel air venting system, and fully automatic high pressure oxygen tanks, cost \$58,000.

To provide easy cabin entrance, an open-type step extends from the fuselage edge of the right wing and retracts into fuselage beneath rear baggage compartment. Step is carried by a lever tab that is supported in bearings so it may rotate in closing or opening.

FAI's telescopic step also may be extended or retracted, when aircraft is parked, using a lever-operated switch located on the right side of fuselage back of rear baggage compartment door.

In automatic operation, the step will extend whenever the right engine is started or right engine fuel panel is turned on, as in operation is equipped by pressure switch in right engine fuel system when fuel pressure reaches 14 psi. Step retracts automatically when right engine is stopped and boost pump turned off.

Should the right engine be lost in flight, extension of step is controlled through landing gear safety switch. Right main door must be unopened by weight of airplane before step will extend.

#### Stop Circuit-Breaker

But potentially, essential, in event of right engine out in single-engine landing, could be to pull stop circuit breaker. This would prevent step retraction in event of malfunction followed by emergency go-around.

Design of cabin door incorporates a new landing mechanism including positive visible main lock and latch at top, back and bottom. Backlock is new-type rubber door seal.

Remote control is used to operate main door panel. However, dual controls are possible and therefore type administrator control also allows for emergency landing.

FAI's step, lighted tail entrance canopy, as well as the D50, are panel-mounted on left fuselage internal. Two

cabin door actuator are located into the panel, which contains electronic control of fuel engine fuel panel and quantity gauges, both lights, are mounted above each of panel. Fuel booster pumps, actuated by three pressure switches, are positioned at the end of the fuel line. Both booster pumps have tanks for takeoff and landing. Fuel should be used from its main for the first hour of flight to offset vapor intrusion from positive refueling, which causes three gallons of fuel per hour per engine to warm tanks.

Control system operates through fuel actuator valves permitting use of fuel from either main tank to either engine. Radio model D50 cross-feed fuel valve, each.

At left of instrument panel, positioned slightly as seen from left, are accessibility, as well as engine ignition switches, one for each engine, plus two engine starter switches.

New short-circuiting, largest instrument panel consists of instruments except fuel gauges and gear position indicator. Pilot's airspeed is displayed according to SAE recommendations in front of pilot. Engine instruments are contained above throttle quadrant and radio panel is mounted in right of quadrant as front of cockpit.

Flaps and gear switches, with safety locking levers, are positioned on opposite sides of quadrant. Instruments and controls are crash and not accessible from either left or right seat.

Yoke controls, which are mounted under throttle quadrant. Control levers are located in left and right side panels below the instrument panel except for gear and landing gear motor, which are mounted in the floor just ahead of pilot's seat.

#### Edge Lighting

Individual instruments feature small, hooded bulb lights. Along with fuel panel, radio control panel and over head light control panel are edge lighted. Fuel side channels also control light intensity of engine and flight instruments, map lights and cabin and lights.

Two radio headsets are mounted in cabin door. Pilot's lightweight T-15 headset, carrying type, can be used in flight if it is designed to reduce the level of outside engine noise. Headset is stored in special compartment directly below pilot's left arm rest, along with microphone and headset jacks.

New visible glass shield, on forward instrument panel, shock-resistant shield extends about six inches from top of panel, is about one inch thick.

Top instrument, constant-flow oxygen system is installed oxygen. Pressure regulator, on seat backboard, regulates flow. Larger orifices for pilot and co-

pilot give them twice as much oxygen as passenger. Lightweight step (expandable-type) inside seat rail.

Emergency exits are provided through windows adjacent to passenger seats on both sides of fuselage. Quick-release emergency exits are provided for each window.

FAI's automatic landing and ventilation system, thermally controlled, provides heating and cold fresh air both inside and on ground. System also has manual control for individual protection.

As seats are set on board, at angle, for flexibility.

#### Cold-Weather Starts

Optional engine pre-heat system, for cold-weather starts, consists of flexible drains connected to heater discharge system, which can be plugged into oxygen in engine manifold.

In different seating arrangements, a few from four to accommodate capacity. Demonstrator used three-place layout with three place and one place lounge chair and reclining chair in rear.

Other arrangements include two seating chairs (one positioned by window, plus pilot's and captain's seats), one three-place lounge chair and one two-place lounge chair.

Two place front seat, includes, sliding cockpit seat mounted on tracks, which gives rise, entrance to rear seat. With two seat and adjust to cabin door frame forward for accessibility to the seat.

Two separate baggage compartments are all of cabin door and one in nose panel 55 in. of it change space. For weight compartments, 100 lb. maximum allowable load, that in the rear can be loaded in maximum of 100 lb. Electric guard-rails prevent engine starts when nose baggage door is open.

New three 40-watt incandescent lights are available for interior design. Lights are available with low resistance, plus combination of incandescent tubes and suspended Danish fixtures.

Optional soundproofing, which is plus low external ground on inside side surface. This is topped with Fiberglas material, a panel of aluminum sheeting, one Plexiglas, then upholstery. Insulation was built into rear bulkhead.

When working with built-in materials in Davis Aircraft Products, Inc., are related to match interior. Bells feature new, good-looking looks.

#### Licensing Engine Gets Three-Way Study

An intensive three-pronged study by Licensing, Aero Design and the Civil Aeronautics Administration is in progress to determine the case of better being issued through the patent on

**Cessna Sees Decline**

Cessna Aircraft Co. believes that its 1966 aircraft volume will decline somewhat in 1967. According to the company's recently filed annual report, Cessna notes that it does not expect that the demand for the Model 172 and 180 will hold the sales level of 1966.

It also notes that sales of the light twin Model 440 will probably drop from the 1966 volume. Reason: The past year demand for light twin aircraft has been largely satisfied by the high volume for the past couple of years, Cessna states.

August's old terminal building. New installation is equipped with Link Trans modems to incorporate automatic and, remote maintenance and real-time data to facilitate aircraft.

Via Dunes Aircraft Supplies (engine) Engine, Aeroquip Corp., Richmond, Va. and will operate the line in its Southern Division. Via Dunes continues to operate in Alexandria, Va., but has to serve the Washington, D. C., area.

Three aviation scholarships have been established at Michigan College, Aviation Department, Columbus, Miss. Airline Division Flight Scholarship will be awarded to a student at the end of her first year, provided he is applicant who has not received any other scholarship from the state. Wallace Airline Scholarship, given by Cessna, goes to a outstanding first year student for flight study and the third scholarship has been presented by Mr. Allen Dean, president of Beech Aircraft Corp., to stimulate interest in aviation study.

Industrial subsidiaries in Page Tri-Force is presented in pocket size 17-page promotional brochure written and illustrated by Bill Mankin, editor of *Wings* and *Wings* 1967 edition. Attached to the brochure is a stamped addressed card to Page Tri-Force department requesting further information.

Outboard projects are involved by Lynn Industries, Inc., to visit in Rockford, Ill. best equipment testing laboratory using the company's Aero-Cor model testing plane at no charge. Grants are awarded to buy good, good, low price for a detailed analysis of procedures recommendation by the laboratory.

## PRIVATE LINES

American Aerobics will spend \$2 million on a maintenance shop expansion project at Miami (Fla.) International Airport designed to service turboprop and turboprop propellers. The firm expects to spend \$100,000 worth of line maintenance for Vickers Viscounts of Colonial Airlines and that will West Indies Airways. When the new building is completed, it is about one month, the maintenance firm expects to increase employment to 500, bringing total to 1,300.

Flight guide in Latin America and the Caribbean, which provides data on regional destinations, flight procedures, flight information, needed equipment, check list and various other valuable tips. Write Flight Guide to Aeroquip Corp. & Pilot Shop, Washington, D. C.

Executive pilot training facilities of Flight Safety Inc., McGraw-Hill, N. Y., are expanded with opening of a branch operation at Houston Municipal



**Italians Produce Personal Plane**














Two-place Aeromobili Pado F3 piston plane is designed for top speed of 214 mph on a 177 hp. Grossing 1250 lb. on gear. Normal cruise speed at sea level is 165 mph. The Pado F3 flies at an approximate 180 ft., level at about 900 ft. It has a two-place hydraulic landing gear. Gross weight is 1,440 lb. and empty weight is 1,037 lb. Service ceiling is 15,000 ft. and range with a full tank is 740 mi. Aeromobili provides three discounts: Spin, 24.24 in. length 21.25 ft. Spin F-3 is produced by Aeromobili Contratti Aeromobili, Milan, Italy.



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Whether single components or complex packaged systems, virtually all operational military aircraft (and civil, too) use reliable Giannini precision-crafted instruments and controls.

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Torquefree Frakes	Differential Pressure Flight Angle Computers		Low Pressure Transducers
			
Gyro Instruments	Accelerometers	Aerodynamic Angle of Attack Transducers	High Pressure Transducers
			
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## AVIONICS

### Gains Reported in Avionic Reliability

By Philip J. Klaus

Washington—Air force equipment systems with "much improved reliability" is one military industry service as a result of major gains made over the past year.

The encouraging report was made by James M. Bridges, senior specialist at Los Angeles-based National Symposium on Reliability and Quality Control in Electronics. Bridges is director of electronics in the Office of the Assistant Secretary of Defense for Equipment.

Examples cited by Bridges as evidence that aviation-reliability programs are finally beginning to pay off include:

- The engine system—believed to be the one developed by Hughes Aircraft Co. for the F-105—has had extra time between failure increased from three to 15 hours during the past year. Despite the fact that the system has 43,000 parts—more than twice as many as older Hughes systems—the mean time between failure is three times greater.

- Avionics digital fault diagnosis computer developed by Librascope with 30,000 parts—including 100 tubes, 96 transistors and 5,000 diodes—has operated for 450 hours, 11% of time as the air is tested normally, with only four failures. Only one of these failures affected flight availability, according to Bridges.

- One magnetic communication bus is actual mean life between failure from 45 hours to more than 200 hours through improved design and manufacturing processes.

- Transistorized multichannel telegraph set containing 578 transistors and 210 diodes has operated over 1,000 hours with only two transistor failures.

#### Little Progress in One Area

The one area where encouraging progress has not been made, according to Bridges, is "in improving the policies and practices of procurement." He added:

"Expenses on competitive cost in the procurement at both development and production is still a major deterrent to obtaining real reliability in military electronic equipment."

"It is unfortunate that a highly reliable equipment will not be produced if the price has been forced so low that short cuts in engineering or even interfering are required."

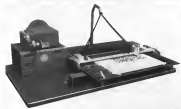
"Neither have we made much progress in ensuring professional people that substantial reliability improve-

ment results from keeping the manufacturer on the job through development and usual production."

Bridges, however, said he hopes that

these and other meaningful factors in aviation improvement will be overcome in 1971 "to direct action or less than education."

One of the important reliability lessons learned from the solitary Titan



#### Automatic Punch Press

Automatic punch press developed by General Electric, operates from punched tape (control). Machine can punch 40 holes per second in predrilled sheet. Bands with hole locations accuracy of .001 in. Punched tape program is prepared from enlarged drawing of panel board showing hole locations. Operator selects punch size, then positions photograph over drawing and pushes it into hole counter which records its location on punched tape. Tape control and program are developed by GE's Light Microscopy Electronics Department Dept.

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*Shoglen*

INSULATIONS

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program is that controlled laboratory service tests under simulated operating conditions provide far more reliable data faster than that provided by actual field tests.

For example, early field tests on Taurus air achieved a total of only 5,800 test operating hours over a 13-month period, preparing more design problems. Subsequent controlled laboratory tests on 190 city accomplished a total of 50,000 test operating hours in only four months. These revealed the need for 27 design changes in comparison with the nine dictated by the previous year of field tests.

The program leaders said, "To get a single lesson regarding the value of controlled operating tests, whose variables can be carefully controlled, in the remaining design and component weaknesses in a short period of time." Budget leaders such tests are seen of time, money and manpower.

The tests also provided valuable reliability statistical data that has enabled the Navy to make specific reliability requirements with its own design procurement contracts.

This is one of the last estimates, Budget and of the nation's writing a quantitative reliability requirement into its procurement contracts and "signified a great step forward in the campaign for better reliability."

#### Data Feedback

Budget and the remarkable improvement in the reliability of the F-102 for control action obtained from a Hughes program which provided rapid feedback of data on failures occurring during production test to its engineering department for speech analysis and correction.

He pointed out that this kind of production reliability improvement program is possible only when the design and initial production are done in the same contractor.

Such an arrangement is "costless," Budget said, to meet the intent of the Department of Defense Directive No. 32211 (issued Feb. 5, 1955) which requires reliability testing of new equipments and pilot production prior to full-scale production.

Budget said the Army has recently implemented this directive, and that the Air Force and Navy are in the process of doing so.

The new Defense Department program is set up a uniform field failure operating system for all military services so that such information can be quickly processed and analyzed to establish comparable data for evaluating actual field reliability with that obtained in controlled reliability tests in the laboratory.

The program also should make it



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Douglas D-47 with OROQUOIS

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But the only way you can fully appreciate the advantages of new Contour-Trentweld is to try it. We think you'll agree, it can't be beat by any other pipe, welded or not.



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Naturally, in producing welded pipe, the weld is made at the top. But you don't always place a pipe track. It stays in the fixed metal until a weld runs, and then it drops toward the middle of the pipe. The result? A weld that's not in the middle — it's in the upper half, where it hinders the most — made on the 112 and not the 110. It's not fair, but that's the way it is. And that's the reason why it's not a weld — it's a weld — and a constant wall thickness of the pipe.



But Trent put a stop to that — simply by going into position with the pipe. With their exclusive Contour-Welding process, they weld at the bottom — and gravity works for them. For there the weld is in the middle — and the pipe is finished in perfectly with the contour of the pipe. And it's done.



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Welded Tubing**

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possible to establish an order of reliability for specific tubes and components that will enable component manufacturers to predict overall reliability during design as well as enabling component users to improve their products.

### Standardized Modular Design

Designs noted that the Navy Bureau of Aeronautics has issued a preliminary preference for uniform, common, proposed standardization of dimensions for piping modules to be used in all of its aircraft equipment. The Air Force has a similar program including defining reliability specifications for new airborne communications equipment.

Design hopes these programs will result in a single point source standard for avionics equipment. Such action, he said, would have a very beneficial effect upon reliability because of the potential increase in production quantities of similar modules.

The war task groups that the De-

fense Department's Advisory Group on Reliability in Electronic Equipment (AGREE) set up more than a year ago for an effort neither neither attack upon the reliability problem nor reported to reflect these individual reports soon. These include specific recommendations for quantitative reliability specifications, procedures, tests and procurement practices needed to assure reliability.

### Individual Task Group

The individual task group reports will be combined into a single report which should become available to its users before fall. Design and the report will represent the most complete and valuable analysis of the many phases of the reliability problem ever compiled and should be a major contribution to further progress in reliability.

Despite excellent progress to date, Design says the reliability battle is far from won. The reason, he says, is that most are becoming extremely busy, complex and the demand for more and

more reliability increases accordingly.

"The cost of repair and spare parts is constantly increasing, as well as their lethality. The penalty for a component is therefore becoming progressively more serious and unacceptable."

## Airborne Radar to Aid Air Traffic

An airborne radar beacon which will enable commercial and business aircraft to get a traffic control center into the air has been developed by Radio Corporation of America.

The compact 25-pound device, known as an Air Traffic Control Transponder Beacon (ATVQ-60), is hardly bigger than a bad lot, yet has a receiving and transmitting range in excess of 200 mi.

Dwight H. Reimann, with the transponder beacon, more effective solution of the problem by commercial airlines and business aircraft, particularly in busy terminal areas, since it identifies the aircraft as soon as it comes within range of the air traffic control center's interception frequency.

The device is triggered automatically by ground-based interrogator transmitters. The ATVQ-60 transponder station, which contains a generator, broadcast of its identification in coded form, which is received on a microphone in the ground station.

This information enables the traffic controller to identify and locate the approaching aircraft, notify other airplanes in the vicinity of its presence, and assign it to a particular runway so that it can be scheduled into the main traffic stream.

Naturally, aircraft must radio their location and identification to the controller and then wait radio confirmation from the center or tower that they have been identified positively in the traffic complex.

Transponder-equipped aircraft, by speeding the identification procedure and location fixes, contribute to more rapid and precise traffic flow.

The RCA AEC transponder measures only 42 inches wide, 74 inches high, and 15½ inches long, is housed in a standard 1 ATR form factor and is designed in compliance with Army specification 332-A.

Reimann said the ATVQ-60's compact dimensions result from a new design approach to transponder circuitry.

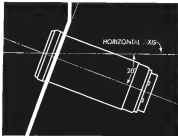
Some major engineering advances include:

• The first use of a beam of infrared light for coding operations. The application of an electronic light bulb instead of one-



## Electro Wing Jigs

These massive, 9-ft.-long, 15-ton jigs are for Lockheed's Electro Aerospace Transport. They are two jigs, one for the upper and lower sections of the right and left wing. Accuracy of milling edges and of wing root locus is scheduled to start immediately. The jigs, which were completed ahead of schedule, are now in assembly of 605 in. First flight of the 450 mph transport is planned for January 1955.



## NEW BENDIX TURN AND SLIP INDICATOR FOR TILTED PANELS

If there's one thing you can't do about the aircraft industry, it's the fact that its problems are always changing.

For instance, the introduction of slanting instrument panels on some of the new aircraft meant radical changes in the way tilt indicators could be designed.

The answer for turn and slip indication is the new Bendix Type 1720, which is slanted at 20° to compensate for the new tilt mounting, without any adverse effect on accuracy.

For information on turn and slip indicators, accelerometers, air speed indicators, magnetometers, radio-altitude indicators, engine heading equipment, fuel flowmeter systems, and electronic timing circuits, write: PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAYTON, OHIO 45424.



Now, air-driven Type 1720 Bendix Turn and Slip Indicator with 2° tilt error performs same functions as battery Type 160-2. Two- and three-inch electric indicators are also available.

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Canadian Office: Bendix Canada Ltd., 200 Lawrence Blvd., Woodville, Ontario.

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AVIATION CORPORATION

round tipped delta faces eliminate approximately 100 manually imposed components with related reflections in equipment size and weight. This, too, permits greater flexibility in the arrangement and availability of electronic sets of identification code groups. The pilot has access to 161 different code groups via side of the top of a switch.

• **Reliability construction.** The RCA transponder features five sub-assemblies which can be disassembled quickly for inspection, maintenance or replacement.

Included in an RF section, IF and video amplifier, decoder, coder and modulator power supply, sub-assemblies for vacuum production process and operating reliability. Some diodes are used exclusively in the power supply to ensure longer, trouble-free operational life.

## London Firm Develops Dielectric Test Sets

**London.**—An instrument known as a dielectric test set for determining the electrical qualities and behavior of plastics, high temperature resins and other materials under the conditions of extremely high frequencies used in radar systems has been developed by Nipponkai Ltd., 50 Kensington, London W 8 2, England.

Another application of the equipment is the testing of materials used in the construction of aircraft radomes and in this connection, the company claims the set is able to measure dielectric characteristics at frequencies comparable with those generated in flight in the surfaces of supersonic aircraft which can rise to more than 105 degrees C.

The equipment has been designed for use by chemists who have little knowledge of electronics. Controls have been kept to a minimum and varied adjustments eliminated.

## Edo Designs New Airborne Loran

A new airborne Loran receiver developed specifically for installation in aircraft has been announced by the Edo Corp., College Point, N.Y. designer and manufacturer of precision electronic and navigational equipment. The new, light weight unit, designated Edo Airborne Loran, Model 345, features a compact construction and digital reader pilot control and has an installed weight of approximately 16 pounds. Model 345 is a direct reading form



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All-seeing radar pinpoints the target for these Air Force planes. Whatever maneuvers they carry—gun, rockets or missiles—fire control radar tells them where and when. It provides the pre-sighted vision necessary for modern long-range combat operations.

Today's modern fighter plane is an electronic wonder, with fire control radar-computer systems supplying a continuous

flow of information about target position in terms of range and rate of closing.

RCA is a major supplier of airborne fire control equipment to the Armed Forces.

It has perfected, and in several instances developed, these systems for many of the latest aircraft. Some of these are illustrated above.



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## NEW STRUCTURAL CONCEPTS FOR MODERN FLIGHT



### high temperature brass stainless steel honeycomb SANDWICH PANEL STRUCTURE

Developed by Bell, unique in thickness from one-eighth of an inch to five inches and is used for structural, tapered, curved and compound contoured panels for wing, vertical surfaces and various fuselage applications. Strength values: alloy composition 140-500 psi. single beam 35-inch span, 140,000 psi. short beam two-inch span: 600 psi.  $F_y$  is from 170,000 psi.

### HIGH STRENGTH WELDMENTS

Produced by Bell meet high strength weight and requirements for modern airplanes. Bell has developed special techniques for hot loading of detail parts and for best treatment. Design of the weldments is an important factor in successful production, which is why Bell supplies all production design of the units.

### METAL BONDED STRUCTURE

Composed from steel, aluminum, stainless and honeycomb core, and is being produced by Bell for wing, fuselage and engine nacelle. Also, various trim tabs, door openings and many other similar applications to take the place of rivets and bolts. Many such structures handle the joining of dissimilar metals to achieve weight reduction, strong weld joints and internal design.

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remote testing remote control, anti-vibration frequency control, and a self-test characteristic. The flexibility achieved by the remote control of all vehicles permits the exclusive and control unit to be mounted in isolated space areas, such as the instrument panel of an aircraft.

The receiver, with four crystalline tuned circuits at frequencies of 17.78 Mc, 18.93 Mc, 19.00 Mc and 19.03 Mc, has a wide band, superheterodyne circuit capable of handling reception under adverse conditions. Signal drift, due to complexities of pulse repetition has been eliminated by automatic control of the frequency reference oscillator. Power requirements of the Model 141 are: power supply, 115 v., 400 cycles single phase (approximately 175 watts); 24 volt d.c. 0.5 watt; Electronic power regulation provides for a line variation of 10% to 130 volts with no change in regulated output.

The installed weight of 26.25 lb. as contained in the 100 pounds of the AFN-9 now in use in airborne signal devices, makes the new unit attractive to airlines and the military services, which place a high premium on space and weight on the flight deck.

Creation and operation of the new Bell unit is a development of the current loan which the company has been producing for some time.

Bell has been associated with the aircraft industry since 1925, in the leading manufacture of engine parts. During World War II the company created the electronic field for both military and civilian equipment. The company also is active in hydrodynamic research.

## Earnings of Bendix, Others, Increase

Bendix Aviation Corp. reported net sales, operating and other operating income of \$58,418,734 for the year ending Sept. 30, compared with \$57,349,023 for the previous year. Earnings were \$24,278,351 (or \$1.04 per share) as compared with \$21,035,990 (or \$1.19 a share) for 1951.

Bendix President Nicholas P. Freese said a \$12 million increase in profit, a number of new-product programs and substantial reorganization associated with moving into aerospace engineering engineering "affected the year's operations."

Banking used at \$144 million of the year's end, compared to \$108 million for the previous year.

For the first time, Bendix was allowed to report that its Kansas City Division has for eight years held a prime contract with the Atomic Energy Commission for manufacture and assembly

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## Navy Contracts

Following is a list of unclassified contracts of \$75,000 and over as released by Navy Contracting Offices.

### MAKING OF AIRCRAFT, Washburn, N. Y.

**Robert Aircraft Corp.**, 140 Broadway, New York, N. Y. 2, held unclassified contract for emergency alternative repair installation and replacement of aircraft engines and other engine equipment. (NMAA 21-007-0133-001-001-01) \$10,000.

**Quadrant Aircraft Corp.**, 1400 E. 10th Avenue, Denver, Colorado, held unclassified contract for emergency alternative repair installation and replacement of aircraft engines and other engine equipment. (NMAA 21-007-0133-001-001-01) \$10,000.

**Security Aviation Corp.**, 17000 E. 10th Avenue, Denver, Colorado, held unclassified contract for emergency alternative repair installation and replacement of aircraft engines and other engine equipment. (NMAA 21-007-0133-001-001-01) \$10,000.

**United Aircraft Corp.**, 1400 Broadway, New York, N. Y. 2, held unclassified contract for emergency alternative repair installation and replacement of aircraft engines and other engine equipment. (NMAA 21-007-0133-001-001-01) \$10,000.

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## USAF Contracts

Following is a list of unclassified contracts for \$75,000 and over as released by Air Force Contracting Offices.

**United Aircraft Corp.**, 1400 Broadway, New York, N. Y. 2, held unclassified contract for emergency alternative repair installation and replacement of aircraft engines and other engine equipment. (NMAA 21-007-0133-001-001-01) \$10,000.

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David W. Wilson, DPT, EdD, MS, has worked for 5-11 years of undergraduate and graduate study but never did VLS and ALE programs mentioned by David D. Wilson. (DPT, M-Ed, MS, EdS, CMAA, FACS) EdD.

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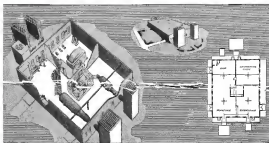
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